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SAMUEL CLARK HARVEY 1886-1953

(From a charcoal drawing by Deane Keller)

Samuel Clark Harvey—Medical Historian 1886-1953

ELIZABETH H. THOMSON*

WERE Samuel Harvey to look up from the book he is undoubtedly reading in the Elysian Fields and see the title chosen for this tribute to him, he would probably take his pipe from his mouth and with his familiar twinkle say, "Aren't you trying to make a lot out of very little?" And one would return an emphatic "no," for surely it would be difficult to find a man who had so consistently made the history of his profession a part of his daily life and teaching and who was thus the ideal medical historian.

Samuel Clark Harvey was born on 12 February 1886 on a small farm in Washington, Connecticut. He had the ruggedness of character, the integrity, the slow manner of speaking, and the quiet but devastating wit which have so often been attributed to the New England Yankee. In addition to this inheritance from his forebears he had the intellectual assets of an exceptionally keen mind, ability to think with clearness and logic, and prescience in judging character. His unquenchable curiosity and wide-ranging enthusiasms made him an omnivorous reader, led him into many fruitful investigations in the experimental laboratory, and contributed to an elasticity of mind and attitude that was a challenge even to the youngest generation of students who were fortunate enough to know him. His enormous patience with people and the problems and frustrations of life in general and his deliberateness in speech gave him more the air of philosopher than busy surgeon, and although surgeons in many parts of the world are feeling the great loss to medicine in his premature death,† yet it is those who succeeded in passing the barrier of his shyness and great modesty and saw him as both surgeon and philosopher who miss him most acutely. For it was only when one came to know that he could always be depended upon for judicious counsel, for a broad, humanistic viewpoint, for practical wisdom and "horse" sense, for

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leavening humor and a puckish whimsy, and for sensitive understanding that one glimpsed the true measure of the man.

Whether or not Dr. Harvey could be considered a medical historian depends on one's definition of the term, which can encompass a wide range in training, competence, and performance. If a medical historian is someone who spends either full or part time teaching the discipline, with or without the title, then Dr. Harvey was not one. And if one were to glance through his bibliography, which was included in the issue of *The Yale Journal of Biology and Medicine* (June 1952) honoring him on his retirement, one would find few titles obviously historical[1] among the 130-odd listed and one would discover on searching through his publications that he wrote little on medical history per se. Yet throughout his entire professional life—in the clinic, in the operating room, in his writing, and in his extra-curricular activities—he regarded medicine and its history as inseparable. One finds again and again that he dealt with whatever clinical problem concerned him by first tracing it as far back as he could. Thus, by constantly integrating the work of earlier observers with present knowledge on the wards and in his writings, he taught not only history, both medical and general, but a habit of approach which would be helpful to his students throughout their careers.

An early example of this may be found in a paper on "Congenital Variations in the Peritoneal Relations of the Ascending Colon, Cæcum, Appendix and Terminal Ileum,"[2] which came from the Department of Pathology of the College of Physicians and Surgeons, where he was instructor in pathology in 1912-1913 after his interneship there, and the Laboratory of Surgical Research at Harvard, where he was a house officer in surgery under Dr. Harvey Cushing (1914-1915) and Arthur Tracy Cabot Fellow in Surgery (1915-1916). The paper did not appear until 1918 when he was a Captain in the Medical Corps stationed with the

[1] The education of Nathan Smith (*Yale J. Biol. Med.*, 1929, *1*, 259-268); The history of hemostasis (*Ann. med. Hist.*, 1929, *1*, 127-154, later printed in book form); Chirurgia: The handicraft of medicine (*Yale J. Biol. Med.*, 1929, *2*, 1-22); A preface and footnotes to a translation by Cornelius P. Rhoads of Theodor Billroth's *Historical studies on the nature and treatment of gunshot wounds from the fifteenth century to the present time* (Berlin 1859) published in *Yale J. Biol. Med.*, 1931-32, *4*, 3-36; 119-148; 225-257; Peter Parker: Initiator of modern medicine in China (*Yale J. Biol. Med.*, 1936, *8*, 225-241); Surgery of the past in Connecticut (*J. Connecticut med. Soc.*, 1942, *6*, 445-458); Effect of the introduction of anesthesia upon surgery (*J. Am. dent. Ass.*, 1945, *32*, 1351-1357); The story of Harvey Cushing's appendix (*Surgery*, 1952, *32*, 501-514).

[2] *Ann. Surg.*, 1918, *67*, 641-686.

Harvard Unit (Base Hospital No. 5) in France. The introduction is followed by a section entitled "Historical" which occupies nearly nine pages in a 45-page study; there is also an extensive bibliography. The pattern thus set so early in his career he continued to follow. An article on "The Clinical Application of Recent Studies in Jaundice,"[3] began thus:

> Jaundice since the time of Virchow has had a fascinating interest for the pathologist and the clinician alike. From the first of the modern work it was recognized as a condition due to the presence of an abnormal amount of bilirubin in the blood stream, which found its way into the other tissues of the body, producing characteristic discoloration, and penetrating through the kidneys into the urine, where its presence ensured the diagnosis. . . . As early as 1840-50, Johannes Müller, Kunde and others extirpated the livers of frogs and as long as four days afterward found no bile pigment in the blood. These experiments were shown to be inconclusive, however, as tying the common duct in this animal does not produce jaundice in such a short period of time.

A paper with Dr. Harold S. Burr on "The Development of the Meninges"[4] has a section on the work of early investigators, while almost half of a study with Dr. Daniel A. Mulvihill on "The Mechanism of the Development of Collateral Circulation"[5] is devoted to historical background. Sometimes these references were very brief, such as the opening sentence of "Concerning the Suture":[6] "When Galen recommended a ligature of Scottish linen thread which could be bought at a certain shop on the Via Sacra, he displayed one of the attributes of a surgeon; that is, fastidiousness in the selection of the materials with which he works." But whether short or extensive, the references to the past were always provocative and were an integral part of the discussion, not merely scholarly allusions to enhance the text.

Dr. Harvey approached his clinical teaching in the same manner. For example, when the General Hospital Society of Connecticut celebrated its hundredth anniversary in 1926, a number of clinics were held at the New Haven Hospital which the Society had established when there were only three hospitals in the country. The other clinics were conducted in matter-of-fact fashion —"The patient, a Swiss male, 26 years old," etc.; but when Dr. Harvey's turn came to speak on surgery in pulmonary tuberculosis, he began with a discussion of the treatment of tuberculosis

3 *Boston med. surg. J.*, 1925, *192*, 540-543.
4 *Arch. Neurol. Psychiat., Chicago*, 1926, *15*, 545-565.
5 *N. England J. Med.*, 1931, *204*, 1032-1034.
6 *Surg., Gynec. Obstet.*, 1934, *58*, 791-793.

in the past and a history of the surgical approach. And almost daily, when cases were presented on rounds, Dr. Harvey drew on his wide historical knowledge to explain or illuminate a point. Sir William Osler had taught medical history in the same way—not so often by itself but in its relevancy to the case in question and as a background against which to measure and evaluate present knowledge and practices.

On such occasions Dr. Harvey's familiarity with general history was evident. He not only knew of the contributions of physicians of the past, but knew the times in which they had worked and struggled to find truth. A good example of this is to be found in the opening paragraphs of his study of the "Effect of the Introduction of Anesthesia upon Surgery";[7] one also gets the sense of his own enjoyment in the writing of such a passage.

> The forties of a century ago were tumultuous years, when there was a pot of gold at the foot of every rainbow, and enterprise and imagination might be and often were extremely productive for the individual and society. During this time, the Mexican War opened up the Southwest for exploitation, while, by forceful negotiation with Great Britain, the Northwest territories were finally delimited and acquired. Horace Greeley's "Go West, young man" was the slogan of the period. Fortunately, not all young men followed his advice. Many sought advancement in the industrial surge in the East, at least as turbulent in Connecticut as elsewhere. So in Hartford, during this time, one would have heard talk of the damming of the river at Holyoke to provide power for a textile mill, of Goodyear and rubber, of Mr. Colt's new enterprise, of the railroad to New Haven, of Howe's sewing machine, of S.F.B. Morse's electric telegraph and, in quite another field, but none the less characteristic of the times, of Mrs. Sigourney, whose poetic tributes, as someone said, "added a new terror to death."
>
> There might have been some talk too, in the winter of 1844, of the demonstration by a fellow named Colton of the use of "laughing gas" and its ludicrous effects, though this seemed of but ephemeral interest, a passing whimsey, good for a night's entertainment and nothing more. It is true that a young dentist by the name of Wells, who had been present one night at a demonstration, had had a tooth pulled the following day under the effects of the gas, but one surmises that this was passed off for the moment as a foolhardy stunt of no importance and, very likely, some worthy citizen remarked that there ought to be a law against such "monkeyshines" . . . .
>
> The aftermath of this event [Wells' subsequent, unsuccessful demonstration using "sulfuric ether" before a class at the Harvard Medical School] with its display of both human frailty and nobility, and moving like some Greek drama to tragic endings, needs no retelling, but the effect of the introduction of anesthesia upon surgery and secondarily on medicine has received but general and cursory attention. . . .

[7] *J. Amer. dent. Ass.*, 1945, 32, 1351-1357.

Dr. Harvey was a diligent collector of books on history of all ages and countries, and his library contains a large number of general works and biographies. He was particularly interested in American history and had, for example, an extensive collection of the literature of the Civil War and also excellent source material for the study of any phase of Connecticut history. This interest which to him was both necessity and keen pleasure was nonetheless rarely displayed unless called for. An amusing example of this has been told by one of his former students and close associates, Dr. Max Taffel. Dr. Harvey had taken Dr. Taffel, then an Associate Resident in Thoracic Surgery at the New Haven Hospital, to a meeting of thoracic surgeons in Boston. In the evening Dr. Elliott C. Cutler, Surgeon-in-Chief of the Peter Bent Brigham Hospital, entertained a number of eminent British and American surgeons at dinner. With the cigars had come a discussion of the Revolutionary War and the question of whether the United States might not still be a Crown colony if George the Third had had a more able Prime Minister. A lively argument then ensued as to who was the Prime Minister during this period, and the group more or less took sides in favor of Lord X or Lord Y. After a half hour of this, Dr. Cutler turned to Dr. Harvey and said, "Sam, you could probably settle this." Dr. Harvey, who had been chuckling on the sidelines and taking no part in the argument, slowly took his pipe out of his mouth and said, to the chagrin particularly of the British present, "It was neither Lord X nor Y, it was Lord North."

Dr. Harvey belonged to the American Association of the History of Medicine, and when the Beaumont Medical Club, a small group composed largely of Connecticut physicians, was organized in 1921, he was a charter member and held the office of Secretary-Treasurer for over a decade. He did not give many papers over the years but he was one of the most faithful participants whose contributions could never be measured in terms of formal presentations. He was also interested in the student medical history group, the Nathan Smith Club. He was one of the faculty regularly invited to their meetings and often entertained them in his home.

Samuel Harvey is perhaps most clearly revealed as the "compleat physician" in two papers, one on "The Objectives of Medical Education," in which he sets forth what he considers to be the attributes of the ideal physician and proceeds with sound wisdom to outline the most effective way of preparing him for his career

in medicine,[8] and his presidential address to the New Haven Medical Association in 1933. This was entitled "Oikonomia Medika"[9] and is a penetrating study of medical economics which he prefaced with a quotation from *Alice in Wonderland.*

> "Come, tell me how you live," I cried,
> "And what it is you do."
> He said, "I hunt for haddocks' eyes
> Among the heather bright,
> And work them into waistcoat buttons
> In the silent night.
> And these I do not sell for gold
> Or coin of silvery shine,
> But for a copper halfpenny,
> And that will purchase nine."

In it he states:

Man is an emotional as well as a rational animal, and in many instances he aspires to values which to some seem more important than material welfare. Furthermore, he cannot be measured in physical terms and should not be considered merely as an expendable resource. With him there are greater transgressions than that of waste. What these values may be vary with the civilization and the period and above all with the individual. In our day of the scientific method of thought one of these values is the complete necessity of ascertaining and expressing truth, and a second is a sense of responsibility for the character of the civilization of which we form a part. As Lecky writes, "A true account of human nature will recognize that it has the power of aiming at something which is different from happiness and something which may be intelligibly described as higher, and that on the predominance of this loftier aim the nobility of life essentially depends. It is not even true that the end of man should be to find peace at last. It should be to do his duty and tell the truth."

The paper ends with what might have been his own *confessio fidei*—and another quotation from *Alice in Wonderland.*

The price of individualism is respect for intelligence and the truth, and the employment of these attributes not only within one's own microcosmos, but in one's relations to society. This is true of all groups but particularly of the medical profession, for it has been given greater responsiblities than any other. If it wishes to remain individualistic, it must justify itself by profound knowledge, by a keen and open intellectuality, by a complete subservience to truth and honesty, and by an intense fellow-feeling for the other members of society, that is to say, charity. These are but abstract qualities, however, and if not converted into action remain but abstractions. It is necessary in this time of conflict and confusion within society

[8] This paper was reprinted in *The Yale Journal of Biology and Medicine* in September 1953 (*26*, 8-22) following a discerning appreciation of Dr. Harvey and his work by Dr. Max Taffel. Originally published in 1941, it is still in demand wherever curricula in medical schools are being re-evaluated.

[9] *Yale J. Biol. Med.*, 1933, *5*, 323-342.

that medicine, if it is to survive as a profession, be not only on guard but energetically pressing forward all along the line.

> "Well, in our country," said Alice, still panting a little, "you'd generally get to somewhere else—if you ran very fast for a long time as we've been doing."
>
> "A slow sort of country," said the Queen. "Now here, you see, it takes all the running you can do, to keep in the same place. If you want to get somewhere else, you must run at least twice as fast as that."

The serenity and calm which Dr. Harvey displayed almost without exception, even in crises in the operating room, were not always indicative of the man within. Although by nature a person of deliberate action, he had had to discipline himself to a measured tempo because of an early attack of pulmonary tuberculosis which later recurred. He had his share of problems and these he approached, as he did those of his patients, with humility of spirit—his uncertainty about his ability to resolve them wisely being as great as his success therein. For one who took his responsibilities so seriously a sense of humor was a saving grace and this Dr. Harvey had in full measure. He saw himself and all other mortals and their idiosyncracies with objective clarity, and the understanding humor, often seasoned with pungent wit, with which he regarded their foibles was a delight to everyone who had an opportunity to share it.

A well-known New York publisher had secured Dr. Harvey's promise to write a history of surgery—a task he looked forward to doing and for which he was pre-eminently qualified. In preparation he moved his large library into some rooms in the Historical Library where he was soon a familiar figure at the card catalogue, in the stacks, or at the dictionaries, for he was keenly interested in the precise definition of words and much of the effectiveness of his easy-flowing prose was due to his persistent effort to find words that would cogently express different shades of meaning. But few men who have been concerned with many activities in a community and university are allowed to "retire," and this was Dr. Harvey's experience. He was President of the American Surgical Association in 1950, he was induced to become medical procurement officer in Connecticut for the Armed Forces, he assumed the editorship of *The Yale Journal of Biology and Medicine,* and when the Department of the History of Medicine was created in February of 1951, Dr. Fulton was quick to take advantage of his presence in the Library and to ask him to join the staff. During 1952 he gave a seminar on the history of surgery and intended to give this elective

each year as well as to assist in teaching the general course in the history of medicine. These activities and others, to which he gave so much, kept him from work on his history of surgery and, although he had spent a lifetime preparing for the writing, he was not able to build this particular "float to posterity." His books, however, he gave to the Yale Medical Library, and perhaps one of his students may some day give substance to his plan.

The title chosen for this appreciation indicates only one facet of a many-sided personality whose other talents will receive the attention they deserve from those more capable of evaluating them. Primarily, of course, he was a surgeon—an extraordinarily versatile surgeon since he did not restrict himself to any particular branch, such as thoracic surgery or neurosurgery, but was at home in all. He had to assume the burdens of an administrator, having been Chairman of the Department of Surgery at the Yale University School of Medicine for twenty-three years and Chief Surgeon to the New Haven Hospital (later Grace-New Haven Community Hospital) for an equal length of time. He was an imaginative experimentalist who made contributions toward the solution of many problems in surgery and medicine, his work on every phase of wound healing being of special importance. He was a book collector who personally provided a department library for the use of his staff twenty-four hours of the day every day of the year and who in addition made available his own rich library housed in his office. He was an inspiring teacher whose broad vision and common sense made him one of the authors and principal proponents of the so-called "Yale Plan" of medical education which places the responsibility for their education on the students themselves and allows them considerable freedom to pursue their own interests. He was a scholar, observing, studying, learning, and reflecting throughout his life. And finally, he was a medical historian in the sense that he continually enriched the knowledge of others from the reserves of his own wide learning, thus exemplifying the dictum of Billroth, "Only the man who is familiar with the art and science of the past is competent to aid in its progress in the future." Samuel Harvey thus earned for himself not only the love, admiration, and respect of his patients, students, fellow physicians, and friends for his deeds among them, but he cast a tall shadow among those who have devoted their days to helping their fellow men to a happier and more abundant life.

Some New Letters of Horace Wells Concerning an Historic Partnership

HENRY K. BEECHER* AND CHARLOTTE FORD*

ON 24 January 1848, less than four years after his discovery of nitrous oxide anesthesia, Horace Wells, one-time dental partner of William T. G. Morton, died a suicide at the age of thirty-three. Dreamer and inventor, Wells had known early prosperity,[1] and a moment of triumph as discoverer. This was followed by tragic misfortune. Born at Hartford, Vermont, in 1815, Wells was Morton's senior by four years. When he was nineteen years of age he came to Boston and for two years studied dentistry under preceptors. In 1836 he opened an office at Hartford, Connecticut, and soon became known as a dentist of ability. His mechanical skill and ingenuity led him to invent and construct many of his own instruments, and in 1838 he published a short but creditable work on dentistry.[2]

Wells' practice was not limited to Hartford, and according to Poore[3] he first met Morton on a professional visit at the home of his father, James Morton, then living at Northside, Massachusetts. This was several years before William Morton, born at Charlton, Massachusetts, in 1819, thought of taking up dentistry. But having become interested in it as a profession shortly after his twenty-first birthday, he went to Hartford in 1841 and studied[4] with Wells, later beginning to practise dentistry at Farmington, Connecticut, nine miles from Hartford. Wells had instructed, among others,

* Boston, Massachusetts.

1 In letters to his family during his first years of dental practice, Wells refers to his profits, writing his sister on 29 August 1836 that they were "from about five to twenty dollars per day." See W. H. Archer, "Life and letters of Horace Wells, discoverer of anesthesia; chronologically arranged with an appendix." *J. Amer. Coll. Dent.*, 1944, *11*, 89.

2 Wells, Horace. *An essay on teeth; comprising a brief description of their formation, diseases, and proper treatment.* Hartford, Case, Tiffany & Co., 1838. vi [vii-viii], [13] -70. pp.

3 Poore, B. P. *Historical materials for the biography of W. T. G. Morton, M.D., discoverer of etherization, with an account of anaesthesia.* Washington, 1856. 114 pp. P. 7.

4 Beginning with the biographies of Poore and Rice (see *Trials of a public benefactor*, 1858), many accounts of Morton contain some reference to his having gone to Baltimore to study dentistry at the Baltimore College of Dental Surgery (now University of Maryland, School of Dentistry) that first opened its doors in the autumn of 1840, and in conformity with Rice's statement on p. 27 of the *Trials* it has often been claimed that Morton was an early graduate. Chapin A. Harris, however, a founder of the College and member of the first faculty, in reviewing Rice's book (*Amer. J. dent. Sci.*, 1859, *n.s. 9*, 292-293) denied that Morton had had any association with the Baltimore College, and his name is not to be found in the records.

John M. Riggs, noted for his description of alveolar pyorrhea, and C. A. Kingsbury, who later became one of the founders of the Philadelphia Dental College. During the association of Wells and Morton at Hartford, Wells invented a noncorrosive dental solder for fastening artificial teeth to gold plates. This resulted in the young men forming a partnership and going to Boston for the promotion of the solder. On 21 October 1843 they opened an office at 19 Tremont Row, Boston. When they submitted a sample of the substance they used to the distinguished Boston scientist and physician, Dr. Charles T. Jackson, he did not hesitate to give them a certificate of approval.

The six letters[5] presented in this paper concern their partnership, regarded as a failure by Wells after a few weeks, and dissolved the following year on 18 October 1844. These letters reflect the sensitive, high-strung nature of Wells, who could nevertheless maintain his dignity in the face of disappointment. While giving evidence of Wells' instability (he was ready to dissolve the partnership a month and a day after its beginning, satisfied that it would be a total failure), they also show his desire, as expressed in a letter[6] to his family, to remain on good terms with Morton. Several passages from the first, and one passage from the fourth letter of the series were published in Rice's *Trials of a public benefactor,*[7] otherwise these letters have never before appeared in print as far as we can determine. Although it cannot be said they add materially to our knowledge of the partnership, they perhaps convey something more of Horace Wells himself and therefore are presented in their entirety.

The first letter follows; the passages already published, and since frequently quoted, are indicated by brackets.

Hartford Nov 22 1843

Dear Doctor

Your letter came to hand the other day which I was glad to receive for I had been waiting in suspense for several days to hear from you—Friend Morton you cannot imagine my feelings ever since we started the office in Boston after seeing the ill success we met with and I have passed many sleepless nights in consequence, since the reception of your letter I have not had an easy moment, [we can both of us see at a glance that it is madness for us to go ahead under present circumstances, for the reason that our receipts will barely pay the cost of materials used, even if we had ever so much work

[5] From the Sturgis Bigelow collection, now in the Archives of the Massachusetts General Hospital.

[6] Archer, W. H. "Life and Letters of Horace Wells." *J. Amer. Coll. Dent.*, 1944, *11*, 106.

[7] Rice, N. P. *Trials of a public benefactor, as illustrated in the discovery of etherization.* New-York, Pudney & Russell, 1858. [v]-xx, [13]-460 pp. Pp. 27 and 143.

at the prices you have taken those jobs now on hand] the whole set which you engaged for $80, is worth at least 125,00 for it is a much worse cast than if all the teeth were out, when I proposed waiting for one half our pay until the expiration of one year[8] I supposed we could get a *good* price, but we find it otherwise, you see our expenses are very great and we shall have nothing to meet our quarters bills, which will be between one and two hundred dollars and one quarter has nearly half expired already. [I am satisfied in my own mind that our enterprise will be a total failure. Now let us give it up and jog along here at home as usual] it will prove a dear lesson to me which will not soon be forgotten. If you think it best to continue on we must alter our advertisements for we cannot go ahead with the establishment and receive but just sufficient to replace the gold we use—at least I am not able to do it, and [in case you do not give up the enterprise I of course am ready and do give you notice that I wish to get out of it as soon as our agreement will permit] which will be in six months from this date—[I wish you to understand that I have not the least fault to find with you, I have the utmost confidence in you as a gentleman, and one who will ever aim to act your part well in accordance with the strictest honor and integrity, we have both exerted ourselves to the utmost, and I believe that our ill success cannot be attributed to either of us so far as "goaheaditiveness" is concerned—]

Old Hartford remains as usual, cold weather is setting in with a young snow squall today. Mr. Whitman called on me the other day—folks in Farmington all well—

Do not fail to write by the next mail in refference to drawing our business to a close, for I cannot rest as matters now are—

Yours with Respect

H. WELLS

N.B. You will doubtless laugh when I express a wish that you would make your words a little more distinct after seeing my writing in this letter—But I really spent over one hour to make out the whole of your letter

The practical Morton, apparently grasping the possibilities of their situation, was able to persuade Wells (who had resumed practice in Hartford on 13 November) to postpone any formal dissolution of partnership, and relations between them continued on a friendly basis. Wells and Morton dental advertisements were printed in the papers, and a diploma was awarded them by the Massachusetts Mechanic Association for a case of dental instruments shown at the Exhibition and Fair of 1844.[9]

At Hartford, Morton's patients were treated by Wells. Recorded in his day book[10] for 4 March 1844, is a charge of $50.00 for professional advice or instruction given Morton. The extent of Morton's financial obligation as a result of their partnership has

[8] This statement was contained in their advertisement in the *American Traveller* as of 4 November 1843, and appeared in the paper on 30 January 1844.

[9] Morton, W. T. G. *Remarks on the comparative value of ether and chloroform, with hints upon natural and artificial teeth.* Boston, William A. Hall, 1850. 48 pp. P. 48.

[10] Original copy of Horace Wells' Day Book in Walter R. Steiner Medical Library of the Hartford Medical Society, Hartford, Connecticut.

never been made clear, but Wells, as his letters disclose, considered that he had a valid claim, and Morton later referred[11] to the adjustment of partnership accounts. The money Wells had advanced when they opened the Boston office was refunded to him by Morton. As the year 1844 wore on, Wells' earlier predictions proved to be wrong. Large numbers of patients found their way to 19 Tremont Row. Morton took in two assistants. He also obtained some special instruction in dentistry from the distinguished Dr. Nathan C. Keep, with whom he was later associated in a brief partnership following his public demonstration of ether.

It was during this same summer of 1844, according to his statement,[12] that Morton, who was then engaged in medical studies under Dr. Charles T. Jackson in addition to his dental activities, first employed ether as a local application when treating a patient's tooth. This he had done on Jackson's advice, and since he resided with his wife in Jackson's home, he found further opportunity for investigation of ether until ill health caused him to leave Boston and go to the home of his father-in-law at Farmington, Connecticut. He remained there for some weeks. While there, it is stated, Morton continued his experiments, but they were unsatisfactory. There is of course no mention of his having informed Wells of any early experiments.

Meanwhile Wells, nearing a discovery that was to have momentous results, was apparently enjoying a relatively happy interval engrossed in the routine of practice. His health was good and on 24 August 1844, in cheerful mood, he wrote Morton the following letter:

Hartford Aug 24th, 1844

Friend M—

There is one request which I forgot to make while you were here, that is in refference to my book (Dental Science) which I wish very much. I hope you will not fail to send it on this week with the other articles—I expected to see you before your return to Boston. I wished to say to you that if you wished I would write a new advertisement for you in refference to filling teeth, I presume I can give you one which will be better than my old ones, if you wish it please to write me about it—

Mrs. Phelps has been in and I have fitted a plate to her mouth which I call a perfect fit—the teeth I have not soldered on yet—I presume there will be no difficulty in constructing a sett that she can wear with comfort—

I am just getting into the spirit of plate work and if I could only have as much as I could do at it I think I should be in my element—one thing is

[11] *Statements, supported by evidence, of Wm. T. G. Morton, M.D., on his claim to the discovery of the anaesthetic properties of ether . . .* Washington, 1853. 582 pp., *il.*, 135 pp. P. 47.

[12] *Ibid.*, p. 46.

certain it is the most agreeable part of the profession—Riggs has been doing quite a stiff business for a week past as well as myself—

I had a call the other day from *Dr* Bulock or Bullard—I forget his name —there's a Bull about it and no mistake—he is the man that teaches writing —pulls teeth and trades horses &c &c when he came in I had a Lady in my operating chair—he came round directly in front of her and asks her if she had got the tooth-ache—I think if he had not left just as he did he would have had some kind of ache and the location of it would have been self-evident—N.B. do not forget to send those specimen teeth. Give my respects to your Lady[13] and say to her when she passes through town again she must not fail to call—

Yours H. W.

P.S. I think very likely you will have sent the teeth and bills before this letter reaches you—if so please to send the book by itself for I want it ever so much

Between the dates of the August letter and the next brief communication of this series a great change had taken place in the life of Horace Wells, and its pattern had altered completely. The event that brought him immortality and at the same time misfortune while he lived, occurred at Hartford, on 10 December 1844. The story of his discovery, on that date, of the value of nitrous oxide in relieving pain is a familiar one. He observed a volunteer at a public demonstration of the gas inhale it and then while stimulated injure himself without being aware of it. Wells had one of his own teeth successfully extracted under nitrous oxide the following morning.

On another occasion the partial failure of his demonstration of this gas as a pain-relieving agent is no less widely known. After devoting himself for several weeks to experiments with the gas, which Gardner Q. Colton, the demonstrator, had shown him how to prepare, Wells, with twelve or fifteen tooth extractions under nitrous oxide to his credit, and after considering sulfuric ether as a possible substitute for the gas (by his own later claim), went to Boston in January 1845 to announce his great discovery. Through the assistance of Morton he was given opportunity to lecture and demonstrate nitrous oxide before the class of John Collins Warren at the Harvard Medical School. This time, unfortunately, he administered an insufficient amount of the anesthetic before removing the gas bag and extracting a student's tooth. The boy cried out, and Wells was pronounced an impostor and visionary.

Nevertheless, a seed had been planted: it was destined to grow and bear fruit. In retrospect this demonstration of anesthesia ap-

[13] On 29 May 1843 Morton had married Elizabeth Whitman of Farmington, Connecticut, and Wells attended the wedding.

peared successful to more than one of Wells' audience, as they later testified. Anyone familiar with the vagaries of patients even under modern methods of administering N_2O would not have been unduly distressed by an outcry from the patient. A little more self-assurance here might have saved the day and spared Wells the disappointment his friends believed was a contributing factor in his breakdown in health and subsequent unhappy ending. For Morton, Wells' demonstration held potent suggestion, although he was not to act upon it for months to come.

Whatever the cause of the breakdown Wells suffered following his return to Hartford (he was said to have had a chronic lung ailment), Wells himself attributed it to the failure of his Boston demonstration. "The excitement of this adventure," he wrote,[14] "brought on an illness from which I did not recover for many months, being thus obliged to relinquish, entirely, my professional business."

The demonstration had taken place late in January 1845. On 5 February of that year the *Hartford Courant* carried an advertisement of Horace Wells' house being to let, and eight weeks later, on 7 April, published the following:

> DENTAL NOTICE—Having relinquished my professional business for the present, in consequence of ill health, I do with pleasure refer those who have confidence in me, to Dr. J. M. Riggs,[15] whose professional qualifications in my opinion are not surpassed by any Dentist in the country. This is strong language, but it is said solely for the benefit of my friends who may require any operations on the teeth in my absence.
>
> H. WELLS
>
> Hartford, April 5, 1845.

On 2 June 1845 the *Courant,* still publishing the dental notice of 7 April, contained the announcement of the opening of "Wells' Panorama of Nature" at the city hall at Hartford. Advertised as "a series of Entertainments, embracing the subject of Natural History," the panorama apparently consisted of an exhibition of birds, to which Morton later referred.[16] Music was furnished by a local band, and there was a modest admission fee. The *Courant's* notice for this ran through 5 June and was then dropped, only the dental notice continuing to appear.

[14] Wells, Horace. *A history of the discovery of the application of nitrous oxide gas, ether, and other vapors, to surgical operations.* Hartford, J. Gaylord Wells, 1847. 25 pp.

[15] Riggs, his former student, had extracted Wells' tooth in the famous experiment of 11 December 1844.

[16] Morton, *Statements, supported by evidence . . .,* p. 47.

On 18 June Dr. P. W. Ellsworth (then living in the same house with Wells) published an article in the *Boston Medical and Surgical Journal*[17] containing the statement: "The nitrous oxide gas has been used in quite a number of cases by our dentists, during the extraction of teeth, and has been found, by its excitement, perfectly to destroy pain. The patients appear very merry during the operation, and no unpleasant effects follow."

There is no hint of such proceedings, however, in a letter of 27 June Wells sent Morton:

Hartford June 27, 1845

Mr Morton

Dear Sir I wrote you about two weeks since respecting the settlement of our business, and have received no answer. I wish to know if it is not in your power to make a settlement and bring our business to a close. I have closed my business in this city and am very much in want of funds, an answer by the returning mail will very much oblige

Yours &c
H. WELLS

Four weeks later, bearing a New York postmark, there was another letter as follows; brackets indicate the portion published by Rice.

New York July 31, 1845

Friend Morton

You will see by the date of this letter that I am at present in New York —I came here about two weeks since for the purpose of starting a business to do plate work—I gave up my business in Hartford in consequence of ill health brought on as I supposed by filling teeth—[18] [on giving up my business in H—I went into a sort of speculation[19] which used up my ready means—and I sunk the whole of it]—and what is worse I now fear I shall be obliged to give up my business here for my health is no better but rather on the decline—I am very much in want of money—and I have no doubt but you are now able to make a full settlement with me—you spoke of doing so when you passed through Hartford by and bye but as I shall not be there I shall miss of [*sic*] it. As I am at present labouring under great disadvantage for the want of funds in consequence of my misfortunes, I have made up my mind to come on and see you in a few days and the assistance which you will no doubt be able to render me will be of essential benefit. I have written before coming that you might be prepared to see me—the truth is I am almost in despair in regard to the future in consequence of my inability to work and in connection with my recent misfortunes. Now Dr do your best for me, I cannot tell precisely what time I shall be in Boston but probably very soon—

Yours with Respect
H. WELLS

17 Ellsworth, P. W. "On the modus operandi of medicines." *Boston med. Surg. J.*, 32, 396-397.

18 At this moment of writing Wells appears to have ignored his Boston demonstration.

19 The "Panorama" perhaps.

Curiously enough, there is nothing in the above letter to suggest that he had conferred with Morton a short time before. Morton, however, in reference to the demonstration of nitrous oxide in Boston states:[20]

> The meeting [the demonstration of January 1845] broke up. . . . I saw nothing more of Dr. Wells, but he left my instruments [loaned by Morton for the tooth extraction] at my office very early the next morning, and went directly home. In July, being again in Connecticut, I called on Dr. Wells, and we spent some time in adjusting our former partnership accounts. He had then given up dentistry, and was engaged in conducting an exhibition of birds [the "Panorama"] which he said insured him better health. I went with him to the office of Dr. Riggs, where I spoke of the gas, and asked them to give some to me; but Dr. Wells gave me to understand that he had abandoned the experiment, thinking it could have no practical value.

Beyond all doubt the former partners met in the summer of 1845, but from Wells' letter it would appear to have been in August. On 29 August the *Hartford Courant* published a notice that Horace Wells would resume his dental practice at Hartford 8 September 1845.

Wells continued in practice through 12 October, according to entries in his day book, but he now appeared to lack the necessary interest in his profession, or perhaps ill health caused him to withdraw once again. On 5 November 1845 there was an entry in his day book, but at about this time he turned to the invention or development of an improved shower bath. This brought him into controversy with a tin and sheet iron manufacturer and stove dealer, Colonel Thomas Roberts, who claimed the improved bath as his own idea. The matter was adjusted by a compromise on the part of Wells. Several months later the men formed a partnership for the production and sale of the shower baths. (Roberts had previously manufactured a number of the coal sifters Wells had invented and patented in December 1839).

Although Wells' business association with Morton was officially terminated by the notice of dissolution of partnership, dated 18 October 1844 and published in the *Boston Daily Atlas* of 24 October of that year, the firm name, Wells and Morton, was still to be found in the Business Directory of the Boston Almanac of 1845, and accounts between them were not yet settled. Late in November 1845, Wells again wrote his former partner:

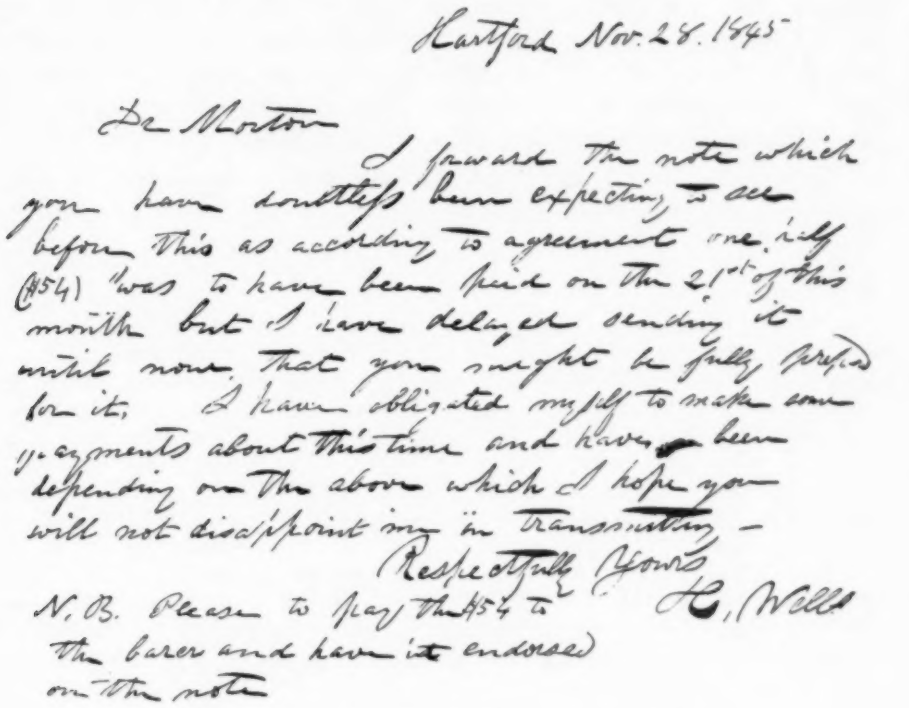
> Hartford Nov. 28. 1845
>
> Dr Morton
>
> I forward the note which you have doubtless been expecting to see before this as according to agreement one half ($54) was to have been paid

[20] Morton, *Statements, supported by evidence . . .*, p. 47.

on the 21st of this month but I have delayed sending it until now, that you might be fully prepared for it. I have obligated myself to make some payments about this time and have been depending on the above which I hope you will not disappoint me in transmitting–

Respectfully yours
H. WELLS

N.B. Please to pay the $54 to the barer and have it endorsed on the note–



Wells' letter to Morton of 28 November 1845.

During the winter of 1845-1846 Morton, a second-year medical student at Harvard, was enjoying a successful dental practice. The laboratory he had opened for the manufacture of artificial teeth was apparently flourishing, and he had several apprentices in the now enlarged quarters at Tremont Row. The actual amount of his yearly income at this time (quoted by Rice as $20,000) has been widely disputed. It was sufficient, however, to have enabled him to purchase some 40 acres of land at West Needham (now Wellesley), where he built his home and developed a "model farm." At this place, so he claimed, he frequently carried out ether experiments on animals and himself prior to his public demonstration of ether anesthesia in October 1846.

Horace Wells had been less fortunate. Practising dentistry at irregular intervals, Wells, in March 1846, formed his partnership with Colonel Roberts for the handling of shower baths. Roberts had charge of the production and Wells traveled through New England and the State of New York establishing agencies for the sale of the baths, later patented. He had not abandoned his interest in anesthesia, however, and according to some reports[21] continued the use of nitrous oxide whenever he practised. It is stated,[22] moreover, that on a visit to New York (presumably in the summer of 1846) Wells called on the eminent surgeon, Valentine Mott, to inform him of the effects of nitrous oxide gas or sulfuric ether as a means of rendering surgical operations painless.

But if one is to judge from the following communication there was little of promise on the horizon for Wells.

Hartford June 8th, 1846

Friend Morton

Dr Sir I have been waiting for a long time to hear from you, not wishing to dun you for the balance due me which was to have been paid a long time since. I have been obliged to give up my business entirely on account of ill health, and am consequently very much in want of money, I heard the other day that you had passed through town without calling on me, I think it must have been a mistake—

I should like to have you answer this letter by the return of mail and say if it will not be possible for you to make a settlement with me in case I send on the papers &c—

I have not practiced any at Dentistry since the 1st of April last,[23] and I sometimes fear I shall never be able to do any more at it—my health does not improve at all—Riggs is doing a large business. Crane fires away as usual—

Respectfully yours
H. WELLS

This was perhaps the last letter he sent Morton before Morton's successful demonstration of ether at the Massachusetts General Hospital on 16 October 1846.

Bitter controversy over priority of discovery was soon to follow, causing Wells to publish his claim as discoverer[24] in the *Hart-*

21 Smith, Truman. *An examination of the question of anaesthesia, arising on the memorial of Charles Thomas Wells, presented to the United States Senate, second session, thirty-second Congress* . . . New-York, J. A. Gray, 1859. viii, [5]-154 pp. P. 26.

22 *Ibid.*, p. 81.

23 There are charges entered in his day book for dental operations performed on 4 April 1846. No similar entries occur in the book after this date.

24 After Morton's public demonstration of anesthesia Ellsworth, in a short paper, "The discoverer of the effects of sulphuric ether," (*Boston med. surg. J.*, 1846, *35*, 397-398) presented one of the first claims for Wells, and later, under the title, "Amputation of the thigh under the influence of the nitrous oxide gas," (*Boston med. surg. J.*, 1848, *37*, 498-499) reported the amputation he had performed on 1 January 1848 when Wells gave the anesthetic.

ford Courant of 9 December 1846. Thus, whatever friendship had existed between the two partners was ended. During the remaining thirteen months of Wells' life he witnessed the adoption of surgical anesthesia. In the storm of controversy, claim and counterclaim, he felt that he was receiving small credit for his own discovery.

In February 1847, during his visit to Paris, where Dr. Charles T. Jackson and William Morton were regarded as the co-discoverers of anesthesia, Wells presented his claim to the Académie Royale de Médecine and the Académie des Sciences. Extracts from his letter were published in the proceedings of both Academies, but there were many who doubted the validity of his claim as he had failed to bring with him to France any sworn testimonials. In answer to requests for such proof he published his brochure, *A history of the discovery of the application of nitrous oxide gas, ether, and other vapors, to surgical operations,* immediately on his return from Europe in March. On the same date that this account appeared, 30 March 1847, he forwarded the original testimonials, affidavits, and other documents contained in it to Dr. C. S. Brewster, an American dentist in Paris, who had taken it upon himself to further Wells' interests at the French capital.[25] (While in Paris Wells had also written a popular account of his discovery which was published in a news sheet, *Galignani's Messenger* on 17 February 1847, and reprinted in English in the Boston *Atlas* of 2 April 1847).

In May 1847 Wells was honored by the State of Connecticut, the General Assembly having passed resolutions stating that he was the discoverer of anesthesia, but by this time the breach between Morton and himself had widened immeasurably; his reaction to this, and his sense of discouragement in regard to the controversy as a whole is perhaps nowhere more candidly expressed than in the first of two letters that he published (12 May and 24 June 1847) in the *Boston Medical and Surgical Journal.* His letter of 12 May[26] is quoted in part:

> Both Drs. Jackson and Morton admit that they were fully aware that I had used nitrous oxide for this purpose [in reference to anesthesia] long

[25] Dr. Charles Wells states: "Horace Wells was made an Honorary Member of the Faculty of Medicine of Paris in 1848, that is to say a few days *after* his death, as they were ignorant of the fact that he had committed suicide. The title was conferred on him with these words, 'Wells, est le novateur de l'anesthésie.'" See Wells, C. J. "Horace Wells," *Anesth. et Analg.,* 1935, *14,* 176-189; 216-224. P. 189.

[26] Wells, Horace. "The discovery of ethereal inhalation." *Boston med. surg. J.,* 1847, *36,* 298-301.

before the date they give as the time of their discovery. . . .[27] Mr. Warren [Edward Warren, Morton's principal agent] states that my experiment before the medical class in 1844[28] was a failure, and all pronounced it a 'humbug.' Now this is perfectly true. The gas bag was removed too soon, and the patient experienced some pain, and I was denounced as an impostor; no one seeming inclined to assist in further experiments. The excitement of this adventure immediately brought on a protracted illness. . . . For this reason, and because I did not wish to incur the responsibility of administering this powerful agent without the cooperation of the medical faculty, my operations have been somewhat limited, but perfectly successful. . . .

Horace Wells was reported[29] to have had some previous knowledge of nitrous oxide, and may have considered its possibilities as an analgesic a few years before the demonstration at Hartford, when he observed a phenomenon and rapidly drew his conclusions. Concerned about the pain accompanying most dental procedures and seeking the means to alleviate it, he had the courage to act as a subject in a seemingly hazardous experiment, carried his investigations further and sought by demonstration and teaching to give the results of his discovery to the world. In addition, he stimulated Morton and indicated the path which led to his great discovery of the anesthetic effects of sulfuric ether. Their dental partnership was brief, but the names of Wells and Morton must always be associated in the history of surgical anesthesia.

27 This was presumably in reference to the much-disputed patent for the discovery, applied for jointly by Jackson and Morton on 26 October 1846, and granted 12 November of that year, although not officially approved and ordered to be printed until 12 February 1847.

28 Wells had become confused about dates and meant the demonstration of 1845.

29 Smith, Truman. *Op. cit.* (see note 21), p. 18.

Dom Duarte and Robert Burton: Two Men of Melancholy

KIMBERLEY S. ROBERTS* AND NORMAN P. SACKS**

Introduction

A comparison of the works of two authors, with parallel passages, generally presupposes the conclusion that the earlier author influenced the later. In the case of King Duarte of Portugal and Robert Burton, however, such is not the case. There is no evidence that the Oxford vicar knew the Portuguese king's philosophical and autobiographical work, the *Leal Conselheiro.* The interest in a comparative study of the *Anatomy of Melancholy* and the *Leal Conselheiro* lies in the fact that, quite independently, both authors developed the same theories on the causes of and remedies against mental depression. Burton, who set out to write a treatise on melancholy, wrote the longer, the more complete work. Duarte's book, which was intended to be a "loyal counsellor" to the very few in Portugal who could read and understand it, is not an account of melancholy alone, but a compilation of various topics, including translations from the Church fathers, instructions for translating Latin into Portuguese, an account of the relations of Duarte and his brothers with their father, and a chapter on diet. The most interesting part of the book, however, consists of the chapters on Duarte's own melancholy, with their penetrating observation of the king's personality—an observation that in its conciseness makes a sharp contrast with the many digressive and wordy chapters that deal with moral and religious questions. Duarte's analysis, written two centuries before Burton's time, is a remarkable document which is not only unique in early Portuguese literature but which probably has found no equal in Portugal at any period. It is the purpose of this paper to show the striking similarity between Duarte's and Burton's approach to a problem that was in both cases a very personal one.

It had been the intention of King Duarte of Portugal, when he wrote the *Leal Conselheiro,*[1] to provide his court with a guide to

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1 King Duarte, son of John of Avis and Philippa of Lancaster, was born in 1391 and reigned from 1433 to 1438. He probably completed the compilation of the *Leal conselheiro* in 1435. The MS of the *Leal conselheiro* is the oldest Portuguese MS in the Bibliothèque Nationale in Paris. The Portuguese quotations are from the edition of Joseph M. Piel, *Leal conselheiro o qual fez Dom Eduarte* (Lisbon, 1942).

proper conduct. In his prologue, addressing his queen, he says: "Madam, you requested me to cause to be written together for you some things which I had written for the good government of our consciences and wills. And . . . satisfying your desire, I considered that it would be done better in the form of one single treatise."

The greater part of the *Leal Conselheiro* consists of essays on moralistic and philosophical topics. Chapters xviii through xxv, however, have a somewhat special interest, since they not only give us an insight into the personality of this religious, well-read, conscientious, and neurotic king, but also can be considered a sort of *Anatomy of Melancholy* in miniature. These chapters provide a number of parallels between the ideas of Duarte and those of Robert Burton in his great *Anatomy of Melancholy*. Both men knew melancholy at first hand, though Duarte tells us more about himself than does Burton. Both had inclinations toward a life of study—a life which in the case of Duarte was rendered difficult to pursue because of his duties. And in both men there existed a talent, which found its way into their books, for "anatomizing" that feeling of melancholy which was an important factor in their personalities.

I. PARALLELS

Duarte, like Burton, recognizes that melancholy can be produced in various ways. In Chapter xviii of the *Leal Conselheiro,* entitled *Da tristeza,* "On sorrow," he lists six chief causes:

> And it seems to me . . . that sorrow generally has these sources: first and chiefly, fear of death, dishonor, pain, or spiritual and bodily suffering. Second, anger. . . . Third, strong desire unfulfilled or delayed. Fourth, unhappiness which we acquire because of dishonor, deaths, losses, imprisonment, illnesses, retention, and longing. Fifth, disordered compression, which truly is called an illness of the melancholic humor. Sixth, talk, conversation of sad persons. . . . By each of these means, more or less, we become sad, according to the feelings and passions which are dominant in each of us.[2]

Most of the elements in this list have their counterparts in Burton's *Anatomy of Melancholy*:[3]

[2] "E a mim parece . . . que a tristeza tem geeralmente estes nacimentos: Primeiro, e mais principalmente, de medo de morte, desonrra, door ou padecimento spiritual e corporal. Segundo, de sanha . . . Terceiro, de rryjo desejo nom comprido ou perlongado. Quarto, de nojo que recebemos por desonrras, mortes, perdas, prisõoes, doenças, e retiimentos, e suydade. Quinto, da desconcertada compreissom, que verdadeiramente doença de humor menencorico se chama. Sexto, per fallas, converssaçom de tristes perssoas. . . . Per cada hũa destas guisas mais e menos recebemos tristeza segundo as afeiçõoes e paixõoes que mais em cada hũu reynam." (Piel p. 67).

[3] The quotations from the *Anatomy of melancholy* are from the edition of the Rev. A. R. Shilleto. 3 vols. (London, 1893.).

["fear of death, dishonor, pain or spiritual and bodily suffering"—Duarte]. "Fear of Devils, death, that they shall be sick of some such or such disease, ready to tremble at every object, they shall die themselves forthwith, or that some of their dear friends or near allies are certainly dead; imminent danger, loss, disgrace still torment others." [Burton, I.444].

["anger"—Duarte]. "Anger, a perturbation, which carries the spirits outwards, preparing the body to melancholy." [Burton, I.311].

["strong desire unfulfilled or delayed"—Duarte]. "This concupiscible appetite, howsoever it may seem to carry with it a shew of pleasure and delight, and our concupiscences most part affect us with content and a pleasing object, yet, if they be in extremes, they rack and wring us on the other side." [Burton, I.324].

["unhappiness which we acquire because of dishonor"—Duarte]. "Shame and disgrace cause violent passions, and bitter pangs." [Burton, I.303].

["deaths"—Duarte]. "Among which [i.e., causes of melancholy] loss and death of friends may challenge a first place." [Burton, I.412].

["losses"—Duarte]. "There is another sorrow, which ariseth from the loss of temporal goods and fortunes, which equally afflicteth, and may go hand in hand with the precedent. Loss of time, loss of honour, office, of good name, of labour, frustrate hopes will much torment." [Burton, I.416].

["imprisonment"—Duarte]. ". . . what misery and discontent shall they have, that live in slavery, or in prison itself!" [Burton, I.397].

["illnesses"—Duarte]. "Now this body of ours is most part distempered by some precedent diseases, which molest his inward organs and instrument, and so *per consequens* cause melancholy." [Burton, I.431].

["retention"—Duarte]. "Of retention and evacuation there be divers kinds, which are other concomitant, assisting, or sole causes many times of melancholy." [Burton, I.267].

["disordered compression, which truly is called an illness of the melancholic humor"—Duarte]. "But the most immediate symptoms proceed from the Temperature itself, and the Organical parts . . . or from the four humours in those seats." [Burton, I.458].

["talk, conversation of sad persons"—Duarte]. "And to those that are now in sorrow, *Seneca forbids all sad companions, and such as lament; a groaning companion is an enemy to quietness.*" [Burton, II.127].

Duarte gives an account of his own illness and cure in Chapter xix, *Da maneira que fui doente do humor menencorico e del guareci,* "How the melancholy humor made me ill, and how I recovered." At the beginning of this chapter, Duarte observes that many persons suffer from a "sin of sorrow which is caused by disordered desire";[4] he himself was afflicted for over three years, but regained his health "by the special grace of Our Lord God."[5] Duarte hopes that this account of his illness will help other melancholy persons, since it is a characteristic of melancholy that the sufferer despairs of ever being restored to a healthy attitude. If one knows that others have undergone these sufferings and have been cured, then one can take hope:

4 ". . . pecado de tristeza que procede da voontade desconcertada. . . ." (Piel, p. 67).

5 ". . . per special mercee de nosso senhor deos. . . ." (Piel, p. 68).

. . . I resolved to write for you the beginning, the course, and the cure of my disease, so that my experience may be an example to others. For it is no small comfort and remedy to those afflicted to learn that others felt what they are suffering and were completely cured. For one of the principal characteristics of the disease is to think that nobody who was thus afflicted was ever restored to the good health which he previously enjoyed.[6]

Burton was likewise moved by the desire to help others who were melancholy: "Something I can speak out of experience . . . I would help others out of a fellow-feeling; and, as that virtuous Lady did of old, *being a Leper herself, bestow all her portion to build an Hospital for Lepers,* I will spend my time and knowledge, which are my greatest fortunes, for the common good of all." (I.19).

Duarte goes on to give in Chapter xix the details of his illness. When he was twenty-two, his father King John I handed over to the young prince a number of administrative tasks. The young man's days were full of official business, with little time for hunting or visits. Finally melancholy set in. To add to Duarte's troubles, Lisbon was visited by an epidemic of plague, and reports came in almost daily announcing to Duarte the deaths of his acquaintances. Duarte himself fell slightly ill. These experiences left him with a fear of death and with a feeling of sadness over the brevity of life. His physicians, friends, and confessors all offered advice, but Duarte found that his faith provided the only comfort that he could obtain: ". . . I scorned all the advice of some physicians who told me to drink wine slightly watered, sleep with a woman, and put aside great cares; and I placed all my hope in the Lord and in his most holy mother."[7]

Burton, although he suggests many remedies against melancholy, shares with Duarte the opinion that God's help is essential:

". . . he alone must help; otherwise our diseases are incurable, and we not to be relieved." (I.205).

"But we, on the other side, seek to God alone." (II.14).

"But the best remedy is to fly to God, to call on him, hope, pray, trust, rely on him, to commit ourselves wholly to him." (III.493).

The idea that melancholy is a punishment for sin is expressed by both Duarte and Burton:

[6] ". . . prepus de vos screver o começo, persseguimento e cura que del ouve, por tal que mynha speriencia a outros seja exempro. Ca nom he pequeno conforto e remedio aos que som desto tocados saberem como os outros sentirom o que elles padecem, e ouverom comprida saude, por que hũu dos seus principaaes sentymentos he penssarem que outrem ja mais nunca tal sentio que fosse tornado a sseu boo stado em que antes era." (Piel, p. 68).

[7] ". . . os consselhos dalgũus fisicos, que me diziam que bevesse vynho pouco auguado, dormisse com molher, e leixasse grandes cuidados, todos desprezei, avendo toda minha sperança em no senhor e sua muy santa madre." (Piel, p. 71).

". . . I thought that Our Lord was giving my heart so much punishment to make me atone for my sins and failings."[8]

". . . if we give reins to lust, anger, ambition, pride, and follow our own ways, we degenerate into beasts, transform ourselves, overthrow our constitutions, provoke God to anger, and heap upon us this of *Melancholy,* and all kinds of incurable diseases, as a just and deserved punishment of our sins." (I.156).

The illness of Duarte's mother marked the beginning of his cure, for he was now forced to turn his thoughts from himself: "In her illness, I was always at her side, and I served her freely, as if I felt no such pain. And this was the beginning of my cure, for since she was suffering, I ceased to feel my own pain."[9]

Since Duarte considered his melancholy as a penance, he felt that it had to be endured; this conviction gave him the courage to fight against despair. At last, he felt that he had regained his taste for happiness, exactly as some regain their taste for food.

In the matter of remedies for melancholy, Burton and Duarte make very similar suggestions. In Chapter xx of the *Leal Conselheiro, Dos aazos per que se acrecenta o ssentido do humor menencorico, e dos remedios contra elles,* "On causes of the increase in the feeling of melancholy humor, and remedies for them," Duarte discusses the steps which he took to combat his depression, and it is well to note that his remedies run parallel to those of Burton:

> I moved away from the plague, and I learned remedies to cure it, and antidotes, the best ones that I could acquire. . . . For unhappiness, I felt that a very useful medicine was the conversation of good and wise friends, the reading of good books of moral teachings. . . . I avoided remaining alone, except for a short time because of some need. And I always found that in such a mood, good occupation in honest and sensible tasks of the body and mind was very profitable, and idleness very much the opposite. . . . I made up for the lack of sleep with proper rest. In drinking, I observed this general rule: a very moderate quantity, and well watered. I remedied overwork with reasonable relaxation.[10]

8 ". . . penssey que nosso senhor me dava tanta pena em meu coraçom por fazer enmenda de meus pecados e fallicymentos." (Piel, pp. 71-72).

9 ". . . a ella em sa infirmydade sempre me cheguey e a sservy sem algũu empacho, como se tal door nom sentisse. E aquesto foy começo de minha cura, por que sentindo ella, leixei de ssentir a mym." (Piel, p. 71).

10 "Da pestellença me afastava, e aprendi remedios pera [a] curar e persservatyvos os mylhores que pude saber. . . . Pera os nojos meezynha muy proveitosa sentia falla de boos e sages amygos, leer per boos livros de virtuosas enssynanças. . . . Destar soo me guardava, salvo pouco tempo per algũa necessydade. E ssempre achei muy proveitosa boa occupaçom de honestos e razoados trabalhos do corpo e do entender pera taaes sentidos, e a ociosidade muyto contraira. . . . A myngua do dormyr curava per sono razoado que depois filhava. No bever pus regra geeral de grande temperança em quantidade, e bem auguado. O trabalho sobejo com folgança razoada enmendava." (Piel, pp. 75-76).

Burton's remedies for melancholy parallel most of these:

["I moved away from the plague"—Duarte]. "In such cases, as in a plague, the best remedy is *citò, longè, tardè* (for to such a party, especially if he be apprehensive, there can be no greater misery), to get him quickly far enough off, and not to be over-hasty in his return." [Burton, II.128].

["the conversation of good and wise friends"—Duarte]. ". . . grief concealed strangles the soul; but when as we shall but impart it to some discrett, trusty, loving friend, it is instantly removed, by his counsel haply, wisdom, persuasion, advice, his good means, which we could not otherwise apply unto ourselves." [Burton, II.123].

["the reading of good books"—Duarte]. "I would for these causes wish him that is melancholy to use both human and divine Authors, voluntarily to impose some task upon himself, to divert his melancholy thoughts." [Burton, II.109].

["I avoided remaining alone"—Duarte]. ". . . observe this short Precept, give not way to solitariness and idleness. *Be not solitary,* be not idle." [Burton, III.494].

["good occupation in honest and sensible tasks of the body and mind was very profitable, and idleness very much the opposite"—Duarte]. "I writ of melancholy, by being busy to avoid melancholy. There is no greater cause of melancholy than idleness." [Burton, I.17]. ". . . idleness . . . the chief author of all mischief, one of the seven deadly sins, and a sole cause of this and many other maladies . . ." [Burton, I.278]. ". . . neither can our health be preserved without bodily exercise." [Burton, II.81].

["I made up for the lack of sleep with proper rest"—Duarte]. "As waking, that hurts, by all means must be avoided, so sleep, which so much helps, by like ways *must be procured, by nature or art . . . as being an especial help.*" [Burton, II.114].

["In drinking . . . a very moderate quantity, and well watered"—Duarte]. "Let's drive down care with a cup of wine: and so say I too (though I drink none myself), for all this may be done, so that it be modestly, soberly, opportunely used: so that *they be not drunk with wine, wherein is excess,* which our Apostle forewarns." [Burton, II.284]. ". . . but to melancholy, which is cold (as most is), Wine soberly used, may be very good." [Burton, II.285].

["I remedied overwork with reasonable relaxation"—Duarte]. "This which I aim at is for such as are *fracti animis,* troubled in mind, to ease them, over-toiled on the one part, to refresh: over-idle on the other, to keep themselves busied." [Burton, II.98]. "If the body be overtired, it tires the mind." [Burton, II.113].

Duarte's statement in Chapter xx that "he who is in good health must, when possible, very much avoid purging, bleeding, and vomiting"[11] is echoed in Burton who, while admitting that purging and bleeding have their use, nevertheless cautions against their abuse:

> . . . if it [i.e., bleeding] be unadvisedly, importunely, immoderately used, it doth as much harm by refrigerating the body, dulling the spirits and consuming them. (I.271).
>
> Purging upward and downward, in abundance of bad humours omitted,

[11] ". . . o que bem estever de saude, purgar, sangrias e vomytos deve muyto scusar quando sse bem pode fazer." (Piel, p. 77).

may be for the worst . . . if overmuch, too frequent or violent, it weakeneth their strength, saith *Fuchsius, lib.* 2, *sect.* 2, *cap.* 17, or if they be strong or able to endure physick, yet it brings them to an ill habit, they make their bodies no better than apothecaries' shops. (I.272).

In Chapter xxi, *Da tristeza que sobre pecados ou virtudes tem nacymento,* "Sorrow which has its source in sins or virtues," Duarte leaves the problem of his own depression and discusses melancholy in more general terms. Some persons are sad because they are unable to carry out evil desires; Duarte considers these to be lacking in faith, since they should on the contrary be glad that they did not sin. This somewhat curious cause of melancholy is not touched upon by Burton. Others, continues Duarte, are distressed because they are not virtuous enough; they blame themselves when they do not attain their high purpose. Duarte thinks that this feeling of unworthiness comes from envy or from lack of knowledge. Burton was aware of the mischief that is caused by an over-demanding conscience; in his section on Religious Melancholy he discusses this problem:

. . . but this of conscience is the greatest [misery], *instar ulceris corpus jugiter percellens*: this scrupulous conscience (as *Peter Forestus* calls it) which tortures so many, that either out of a deep apprehension of their unworthiness, and consideration of their own dissolute life, *accuse themselves, and aggravate every small offence, when there is no such cause, misdoubting in the mean time God's mercies, they fall into these inconveniences.* (III.458).

Duarte, continuing his discussion about those who are sad because they feel unworthy, reminds his readers that although one must avoid sin, it is impossible to possess all virtues; not even the Apostles had equal qualities.

Duarte's study of melancholy continues in Chapter xxii, *Da mais forte maneira da tristeza,* "On the most severe kind of sorrow," with the description of a very violent attack of melancholy:

In addition to the types of sadness discussed above, there is a much more severe kind, which deprives one of sleep and of a great part of nourishment. And it brings pain to the heart with great tremblings and passion. And this takes place because of some very special background of great misfortunes, troubles and losses; and others, by the fury of some wild fancies, experience this same feeling, which is so dangerous that many, for this cause, kill themselves or die naturally through lack of food and sleep and through sorrows which increase on this account. And many go mad.[12]

12 "Aalem das maneiras da tristeza em cyma scriptas, he hũa muyto mais forte, que tira o dormir e gram parte do comer. E traz door ao coraçom com grandes tremores e agastamentos. E aquesto se faz por algũu mui spical fundamento de grandes desaventuiras, malles, e perdas, e outras por arrevatamento dalgũas desconcertadas fantesias veem a este meesmo sentymento, o qual he tam periigoso, que muytos per este aazo veherom a sse matarem per ssy, ou naturalmente morrerem per myngua de comer e dormir, e doores que per este aazo lhe recrecerom. E muytos cãas em sandice." (Piel, pp. 81-82).

This description resembles Burton's account of symptoms of despair in his section on Religious Melancholy:

> All that is single in other melancholy, *horribile, dirum, pestilens, atrox, ferum,* concur in this, it is more than melancholy in the highest degree; a burning fever of the soul; so mad, saith *Jacchinus,* by this misery; fear, sorrow and despair he puts for ordinary symptoms of Melancholy. They are in great pain and horror of mind, distraction of soul, restless, full of continual fears, cares, torments, anxieties, they can neither eat, drink, nor sleep for them, take no rest. . . . Fear takes away their content, and dries the blood, wasteth the marrow, alters their countenance. (III.463).

Suicide as an escape from melancholy, mentioned by Duarte, is also discussed by Burton:

> In such sort doth the torture and extremity of his misery torment him, that he can take no pleasure in his life, but is in a manner enforced to offer violence unto himself, to be freed from his present insufferable pains. (I.496).
>
> Hence it proceeds many times that they are weary of their lives, and feral thoughts to offer violence to their own persons come into their minds. (I.448-449).

For this very severe type of melancholy Duarte offers no cure except religion; one must trust in God, confess one's sins, and resolve to sin no more. In addition, one must not remain alone:

". . . let one be very careful not to remain alone, but always in the company of good, discreet and devoted persons."[13]

Burton, too, repeatedly warns against solitariness:

> If it be idleness hath caused this infirmity, or that he perceive himself given to solitariness, to walk alone, and please his mind with fond imaginations, let him by all means avoid it . . . it will in the end be his undoing; let him go presently, task or set himself a work, get some good company. (II.120-121).
>
> *Be not solitary, be not idle.* (III.494).
>
> Cousin-german to idleness, and a concomitant cause, which goes hand in hand with it, is *nimia solitudo,* too much solitariness, by the testimony of all Physicians, cause and symptom both. (I.282).

Duarte ends his chapter on severe melancholy by pointing out, as he does elsewhere, that God's mercy is still more important than any advice or regimen. Burton agrees:

"For all the physick we can use, art, excellent industry, is to no purpose without calling upon God." (II.10).

Duarte's analysis of melancholy continues with a discussion of weariness in Chapter xxiii, *Das partes do enfadamento,* "On the parts of weariness."

[13] ". . . guardesse muyto destar soo, mais sempre acompanhado de boas, discretas e devotas pessoas." (Piel, p. 82).

Since weariness is a great cause of bringing on sorrow, I considered and learned by experience that it occurred in five ways. First, by hard work at something disagreeable. Second, by overdoing something which pertains to the understanding, so that although one enjoys continuing it, through the affection of the heart, it causes weariness through fatigue. Third, by not having any time available for leisure. Fourth, by illnesses which attack the body naturally or by some event. Fifth, by an increase in unhappiness, trouble, displeasure, hatred, longing, or by the natural sadness of an unsettled will.[14]

Once again we encounter ideas which occur in the *Anatomy* and which warn us of the dangers inherent in too much work, physical or mental:

Fernelius, out of *Galen, Path. lib.* I, *cap.* 16, saith, *that much exercise and weariness consumes the spirits and substance, refrigerates the body; and such humours which Nature would have otherwise concocted and expelled, it stirs up, and makes them rage: which being so enraged, diversely affect and trouble the body and mind.* (I.277-278).

Fernelius, lib. I, *cap.* 18, puts *study,* contemplation, and continual meditation, as an especial cause of madness. . . . *Jo. Arculanus,* in *lib.* 9 *Rhasis ad Almansorem, cap.* 16, amongst other causes reckons up *studium vehemens* . . . For (as *Machiavel* holds) study weakens their bodies, dulls their spirits, abates their strength and courage. (I.348-349).

Illness and cares also are important contributors to melancholy:

"O blessed health . . . without thee there can be no happiness: or visited with some loathsome disease, offensive to others, or troublesome to ourselves." (I.427).

"Discontents, cares, crosses, miseries, or whatsoever it is, that shall cause any molestation of spirits . . ." (I.313).

For each of the five causes of weariness that he lists, Duarte has a remedy:

And it seems to me to be necessary, although the name be general, to know each kind of weariness when I feel it . . . and to know how to seek, with the Lord's grace, immediate remedies. And for me, in general, I found these. For the first kind: to look for something that gives me cause for pleasure. . . . For the second: since it is the result of fatigue rest alone is sufficient; therefore to remain for a while in a secluded place in which one can relax is an adequate remedy for this. . . . And for the third: those who live properly seldom feel such weariness, because they know how to divide their time in such a way that they never lack time to spend well. For when they have nothing definite to do, they will employ their time well in reading, writing, speaking. . . . For the fourth: one must consider that since it is

[14] "Por quanto o enfadamento he hũu grande aazo de fazer viir a tristeza, eu conssiirey, e per speriencia conheci, que se avia per cynquo guysas. Primeyra, por muyto obrar o que lhe nom praz. Segunda, por tanto sobejo fazer algũa cousa, que ao entender perteeça, que, ainda que folgue em a continuar per afeiçom do coraçom, el de ssi per canssaço, filha enffadamento. Terceira, por nom teer que despenda o tempo que lhe dẽ algua, folgança. Quarta, per doenças que venham ao corpo naturalmente, ou per algũu acontecimento. Quynta, por nojo, pesar, desprazer, avorrecymento, suidade que se recreçom, ou per natural tristeza da voontade mal ordenada." (Piel, p. 83).

the result of illness, when the illness ceases the weariness will pass. . . . As for the fifth: one must notice what I have written about these feelings and these remedies, to remember . . . that afterward one regained good health.[15]

Echoes of these remedies occur in Burton, who understands the importance of pleasure: "Nothing better than mirth and merry company in this malady." (II.143).

Repose is a very valuable remedy: "It [sleep] expels cares, pacifies the mind, refresheth the weary limbs after long work." (II.114).

Reading is recommended for one's leisure time: "Who is he that is now wholly overcome with idleness, or otherwise involved in a labyrinth of worldly cares, troubles, and discontents, that will not be much lightened in his mind by reading of some enticing story true or feigned." (II.101).

Burton knows at first hand that writing can ease a melancholy mind: "I writ of melancholy, by being busy to avoid melancholy." (I.17).

Conversation is another important source of release from tension: "Friends' confabulations are comfortable at all times, as fire in Winter, shade in Summer . . . meat and drink to him that is hungry or athirst." (II.124).

Burton reminds the ill that diseases run their course: "If thy disease be continuate and painful to thee, it will not surely last. . . . Bear it with patience." (II.157).

Duarte closes Chapter xxiii with the observation that a good wife is a great comfort to a melancholy man: "And I feel, by the grace of Our Lord, that a good, wise, attractive and gracious woman to whom a man is married, if they love one another dearly, is a great remedy against sorrow."[16]

15 "E pareceme seer necessario, ainda que o nome seja geeral, cada hũu conhecer, quando tal sentyr . . . e saberlhe buscar com a graça do senhor dereytos remedios. E pera mym em geeral achey estes. A primeira parte buscar tal cousa que me dê aazo pera filhar prazer. . . . A ssegunda, por que se geera de canssaço, folga sollamente abasta, assy que estando em logar apartado algũu spaço em que possa descanssar, he pera ello abastante remedio. . . . E per a terceira poucas vezes tal enfadamento recebem os que bem vyvem, porque sabem assy repartir seu tempo que nunca lhe[s] fallece em que o bem despendam. Ca nom teendo cousa certa fazer, em leer, screver, fallar bem o passaróm. . . . Pera a quarta dévesse conssiirar que, pois vem per aazo da enfermydade, cessando ella o enfadamento passará. . . . Sobre a quinta dévesse reguardar o que tenho scripto destes sentimentos e de seus remedios, dessy aver lembrança . . . que depois tornou a sseu boo stado." (Piel, pp. 84-85).

16 "E ssento per graça de nosso senhor que boa, sages, bem parecente e graciosa molher, com que homem seja casado, e se muyto amem, he grande remedio contra a tristeza." (Piel, pp. 85-86).

And Burton the bachelor, in spite of his excursions into misogyny, agrees: "There is no joy, no comfort, no sweetness, no pleasure in the world like to that of a good wife." (II.286).

In Chapter xxiv, *Do consselho que sobr'esto dey ao Iffante dom Pedro,* "On advice which I gave on this matter to the Prince Dom Pedro," Duarte includes some theories about melancholy in his advice to his brother. We have three powers within us, says Duarte, which regulate the physical, emotional, and mental aspect of our lives. When these powers fail, melancholy can occur. Each of the powers must be given proper attention; one must lead a well-balanced life. One must not, for example, try to favor the power that rules the body at the expense of the other two; a person who spends his life eating, drinking, and sleeping will not be happy, since too much attention is given to things of the body. Burton does not specifically go into the question of powers within us, although he does devote several pages to the anatomy of the soul and to the effect which mind and body have on each other. Burton certainly favored a well-rounded life, as is obvious from the many pages that he devotes to games, amusements, and merry company as an antidote for too much work (II.80-114). Of course, he condemns gluttony, drunkenness and too much sleep:

". . . an insatiable paunch is a pernicious sink, and the fountain of all diseases, both of body and mind." (I.258-259).

"To make up the mess, what immoderate drinking in every place!" (I.260).

"Nothing better than moderate sleep, nothing worse than it, if it be in extremes, or unseasonably used." (I.286).

Duarte's last chapter in his little *Anatomy,* Chapter xxv, is entitled *Do nojo, pesar, desprazer, avorrecimento e suydade,* "On unhappiness, trouble, displeasure, hatred and longing"; it has no counterpart in Burton. Here Duarte describes the rather subtle distinctions between the various Portuguese words that denote different kinds of sadness, and discusses in some detail that feeling, Portuguese *par excellence,* of *saudade.* With this chapter we come to the end of the *Anatomy of Melancholy* part of the *Leal Conselheiro.* Through these chapters one sees the portrait of the author, a man quite unlike the great English anatomist of melancholy, but none the less likeable, a man trying to keep up with his duties in the midst of his depression, bearing his troubles patiently, firm in his faith, who finally recovered from his illness and who used his own experiences as a guide to help others.

II. SIGNIFICANCE OF THE PARALLELS

The Burton parallels in Duarte's *Leal Conselheiro,* which have been our principal concern thus far, raise the inevitable question, What do these parallels prove? In an effort to arrive at a definitive conclusion regarding their significance, we have sought the answer to the following questions:

1. What are Burton's known sources?
2. How accurate and complete is Burton in stating his sources?
3. What parallels with the *Anatomy of Melancholy* are known and what is their significance?
4. What is known of Burton's library?
5. What are Duarte's known sources?
6. What is known of Duarte's library?
7. How well known and how widely read in Portugal was the *Leal Conselheiro* up to the time of publication of Burton's work (1621)?
8. How well known in England was Duarte's work, in the original or in translation, up to the time of publication of the *Anatomy of Melancholy?*
9. Could Burton have read Duarte in any language and could he possibly have known of the *Leal Conselheiro?*

Taking up these questions in order, let us first examine briefly what is already known of Burton's sources. Sir William Osler tells us "With but few exceptions the sources of the Burton river are easily traced, and they drain the whole territory of literature, ancient and modern. . . ."[17] Burton conscientiously lists his sources and these may be grouped together as follows: Ancient Greek and Roman authors such as Plato, Aristotle, Cicero, Horace, Ovid, Seneca, and others; the Bible, the Church Fathers, theologians; medical writers of all periods, and scientific works; English writers like Chaucer, Shakespeare, Ben Jonson, Francis Bacon, and others; French writers like Montaigne (in the Florio translation) and Rabelais; Italian writers like Dante, Petrarch, Boccaccio, Poggio, Machiavelli, and Ariosto (in the Harrington translation); Spanish writers like Fernando de Quirós, José de Acosta, León Hebreo, Juan Luis Vives, Christophorus a Vega, and Francisco Valles, as well as the Spanish classic *La Celestina* (in the Latin translation of Barth); two Portuguese writers: Damião de Góes (in English translation) and Valescus de Taranta (in Latin).[18]

The foregoing listing, as well as the *Anatomy of Melancholy* itself and the literature concerning Burton, make no mention of Duarte.

[17] "Robert Burton—The man, his book, his library," *Proceedings and Papers of the Oxford Bibliographical Society,* 1925, *1,* 186.

[18] The grouping given here, which is complete enough for our purpose, follows that of Edward Bensly (as cited by Osler, *ibid.*) and that of Paul Jordan-Smith in his *Bibliographia Burtoniana* (Stanford University, 1931), p. 24 *et seq.*

Burton seems to have been generally honest and reliable in his quotations, except when he quoted from memory or borrowed from second-hand sources.[19] Shakespeare, for example, was quoted three times by Burton, without proper indebtedness indicated.[20] And Edward Bensly, the distinguished Burton scholar, who has contributed numerous notes on Burton's sources and on the Shilleto edition of the *Anatomy of Melancholy* suggests, *inter alia,* that a Latin quotation attributed by Burton to Horace was a slip on Burton's part for Ovid, and that Burton wrongly attributed to Statius a Latin quotation which came from Silius Italicus.[21] Since Burton's errors in stating his sources are relatively few, however, it seems fair to say that on the whole he can be depended upon to give his sources accurately and honestly.

For a discussion of parallels with the *Anatomy of Melancholy* and their significance, Jordan-Smith is very useful, especially his treatment of several "apocryphal" sources of the *Anatomy,* such as the following: Simion Grahame's *Anatomie of Humours* (1609); Thomas Walkington's *Optick Glasse of Humours* (1607); Nicholas Coeffeteau's *Tableau des passions humaines* (1620); Juan Huarte's *Examen de ingenios* (English version, 1594); Pierre Boaistuau's *Theatrum Mundi* (1558; English version, 1566). In the case of Grahame, Walkington, and Coeffeteau, similarities in their works and Burton's are attributed to the use of common sources rather than to any direct influence of the three upon Burton. Though a closer resemblance is admitted between the *Examen de ingenios* and the *Anatomy of Melancholy,* Burton's indebtedness is questioned, a view supported by Burton's failure to mention the work of Huarte. On the other hand, Boaistuau's *Theatrum Mundi,* often mentioned as a Burton source, is known to have been in Burton's library. However, after admitting the existence of parallel passages in the works of Boaistuau and Burton, Jordan-Smith concludes as follows:

> "First, one should note that, while Burton's work is in reality a study of melancholy based upon the best medical ideas of his time, Boaistuau's little book is, in the main, but a recital of human miseries. . . . One will see at a glance that of necessity the two men share the same field to a degree, but where Boaistuau but catalogues Burton amplifies and illustrates . . . that his own work [Burton's] was indebted thereto [Boaistuau's] for more than a slight suggestion is inconceivable."[22]

19 Jordan-Smith, p. 59.

20 *Ibid.,* p. 26.

21 *Notes and Queries,* Series IX and X, passim.

22 Jordan-Smith, p. 5 *et seq.*

Jordan-Smith is not loath to accept such a work as Timothy Bright's *Treatise of Melancholy* (1586) as a Burton source, since more than half of the forty-one chapter headings in Bright's work are paralleled by similar section titles in the *Anatomy of Melancholy,* and Burton himself often acknowledges his indebtedness to Bright.[23]

Burton's private library is known to us, for two lists of his books, which were distributed after his death between the Bodleian Library and the Library of his College, Christ Church, Oxford, have been published.[24] And, for the purposes of our investigation, it is well to note that Duarte's *Leal Conselheiro* is not in either list, nor is there mention of the Portuguese work by Wm. D. Macray in his *Annals of the Bodleian Library,*[25] which begins with the year 1601. These facts are of no small significance in an examination of Burton's sources and bibliography, for "with the exception of a score or so of volumes left to personal friends, the whole of his collection is thus theoretically in those two libraries."[26] And we know that Burton "drew heavily upon the books at the Bodleian for his recondite knowledge."[27]

To summarize: we have seen that Burton does not mention Duarte or the *Leal Conselheiro,* that evidently he did not own a copy of the Portuguese work, and likewise that the Bodleian evidently did not have a copy before the publication of the *Anatomy.* It is fitting, therefore, that we take leave of Burton for a moment and approach our problem from the Duarte side.

The sources of the *Leal Conselheiro* have been given by the Visconde de Santarém in his introduction to the Roquette edition of Duarte's work. These include the following: the Bible; Ancient Greek and Roman writers such as Plato, Aristotle, Cicero, and Seneca; the Church Fathers, especially Gregory, Augustine, John Cassianus, Bernard, Thomas Aquinas, John Climacus, and St. Isidore of Seville; foreign authors of the Middle Ages such as Boethius, Gil de Roma, Hugo de S. Victor, Raimundo Lullo, and André de Pace.[28] And in those chapters (xviii-xxv) of the *Leal Conselheiro,* which we have termed "an Anatomy of Melancholy in miniature," Duarte himself gives the following sources: the Church

23 *Ibid.,* pp. 63-66.

24 See S. Gibson and F. R. D. Needham, "Lists of Burton's library," *Proceedings and Papers of the Oxford Bibliographical Society,* 1925, *1,* 222-246.

25 Second edition, Oxford, 1890.

26 Gibson and Needham, p. 222.

27 Tucker Brooke in *A literary history of England,* edited by Albert Baugh (New York, 1948), p. 598.

28 Paris, 1842, pp. x-xi.

Fathers; St. John Cassianus; the Apostle Paul; Cato; the Epistle to the Ephesians; the Epistle to the Romans.

For a knowledge of Duarte's library we have only to consult the aforementioned introduction by Santarém. Among the books and authors Duarte read are the following: the Bible; the *Dialectica* of Aristotle and of Avicenna; *Miracula Sanctorum;* St. Augustine's *Confessions* and *Meditations;* Caesar; Cicero; Seneca's *Epistles* and other treatises; Valerius Maximus; Marco Polo; O Acypreste de Fysa (i.e., the Spaniard Juan Ruiz, Arcipreste de Hita); *O Amante* (the translation by Robert Payne, Canon of Lisbon, of Gower's *Confessio Amantis*).[29]

If an influence of Duarte upon Burton is to be established, it is necessary for us to know how widely read and how well known was the *Leal Conselheiro* both in Portugal and in England up to the time of publication of the *Anatomy of Melancholy*. So far as Portugal is concerned, Santarém is authority for the belief that the *Leal Conselheiro* wasn't known to Portuguese writers except by title (i.e., none had read the work), and he quotes statements by such writers as Ruy de Pina, Duarte Nunes de Leão, and Fr. Bernardo de Brito to prove his assertion. Santarém's testimony may be concluded with the following citation:

> According to Abbot Barboza, of the many works of this Prince [Duarte] there existed in Portugal only ten, which were preserved in the Carthusian monastery of Evora in a single manuscript bearing the title *Memorias varias,* and the Treatises and lengthier and more important works were entirely lost, only their titles being known. Among the works of Dom Duarte which were for a long time considered lost, were precisely the most important ones, and which today [1842] are published for the first time, that is the *Leal Conselheiro* and the *Livro da Ensynança de bem cavalgar toda sella,* faithfully reproduced from the splendid Codex 7007 of the Bibliothèque Nationale in Paris.[30]

If the *Leal Conselheiro* wasn't read in Portugal before the publication date of the *Anatomy of Melancholy,* it is quite unnecessary to add that Duarte's work was either unknown or unread in England until that time. Were additional evidence needed, it could be supplied by Henry Thomas' article "English Translations of

[29] *Ibid.,* pp. xx-xxii.

[30] "Segundo o Abbade Barboza, das muitas obras d'este Principe nao existião em Portugal senão dez, as quaes se conservavão na Cartuxa d'Evora em um Mss. com o titulo de *Memorias varias,* e os Tratados e obras de maior extensão, e importancia, perdêrão-se de todo, restandonos sómente d'elles a lembrança nos titulos. Entre as producções do Senhor Dom Duarte as que por muito tempo se julgárão perdidas erão justamente as mais importantes, e que hoje apparecem pela primeira vez a luz, a saber o *Leal Conselheiro,* e o *Livro da Ensynança de bem cavalgar toda sella,* trasladadas fielmente do magnifico Codice 7007 da Bibliotheca Real de Pariz." (*Ibid.,* p. vi).

Portuguese Books Before 1640"[31] (the terminus date, as it happens, is the year of Burton's death), in which there is no mention of an English translation of the *Leal Conselheiro.*

An examination of the parallel passages in Duarte and Burton reveals that on the whole Duarte catalogues, whereas Burton amplifies and illustrates.[32] The two men share some common sources, such as the Bible, the Church Fathers, and classical authors like Plato, Aristotle, Cicero, and Seneca.[33] As fellow-sufferers of melancholy, they drew on common experiences.[34] Thus some ideas very likely occurred to both men independently of written sources or literary traditions. Is it surprising, for example, that two religious men like Duarte and Burton should offer religious faith or God's aid as a cure for melancholy? And when we realize that Burton's ideas were those of his age and that he derived some of them (e.g., melancholy is a punishment for sin) from so obvious a source as Timothy Bright, need we look further?

Burton, as everyone knows, was a close follower of certain traditions. The term "anatomy" in the sense of "outline" was quite popular in his time. Burton himself mentions four "Anatomies" and Jordan-Smith, nineteen other contemporary "Anatomies" ranging from an *Anatomy of a Hande in the Manner of a*

31 In *The Library, 4 ser. 7,* 1-30.

32 It will be recalled that the same observation was made by Jordan-Smith with reference to Boaistuau's *Theatrum mundi* as a possible source of the *Anatomy of melancholy.*

33 A few illustrations of this may be of interest. Anger as a cause of melancholy is found in Seneca's *Epistolae morales.* 18. *l.* 1. Burton (I, 311) cites this very source in Seneca. Conversation with good friends as a remedy for melancholy is found in Aristotle's *Ethics,* Book 9, Chap. 2. Burton (II, 123) acknowledges this very source. The recommendation that wine be drunk in moderation rather than to excess is made in Paul's *Epistle to the Ephesians,* Chap. 5, v. 18. Burton (II, 284) gives this same source. Duarte, of course, was well acquainted with all these sources.

34 That Burton and Duarte were men of melancholy temperament is apparent from a reading of their works. John Middleton Murry, in discussing Burton's *Anatomy* (*Countries of the mind,* New York, 1922, pp. 65-67), comments on his melancholy as follows: "No doubt Burton's profound depression had other causes than his own sense of futility. He was born under Mercury, and 'Mercurialists are solitary, much in contemplation, subtile, poets, philosophers, and musing most part about such matters'; this might not have mattered to another man, but Burton happened to believe in the influence of the planets . . . by his own confession the misery of his schooldays was a quite sufficient cause. . . . In the language of modern psychology, Burton suffered under an inhibition; his nerve was shattered, and while he watched himself stagnating, chained by his fear of life to Oxford, his resentment against his destiny accumulated." Oliveira Martins (*Os filhos de D. João I,* 6th ed., Lisbon, 1936, Chap. VI, *passim*) makes references to Duarte's constitutional melancholia, to which the following seem to have contributed: a morbid conscientiousness in respect to Duarte's burdensome royal responsibilities and duties; the fear of impending death, as predicted by his Court Astrologer; fear of the ambitious and grandiose plans of his brother, Prince Henry the Navigator; the curse of chronic indecision which was a constant source of worry; the Portuguese disaster in Tangier at the hands of the Moors. Oliveira Martins adds (p. 166) that if the *Leal conselheiro* had been dated throughout, it would have been a complete diary of the sympathetic and melancholy life of Dom Duarte.

Dyall (154) to *The Anatomy of the English Nunnery at Lisbon* (1622).[35] Burton's use of the pseudonym Democritus, in a work on melancholy, was not original with him.[36] He had predecessors among English writers on the subject of melancholy. In fact a generation of 'malcontent' literature separates Lyly's *Euphues, or the Anatomy of Wit* from Burton's *Anatomy of Melancholy*.[37] In style and in his practice of beginning from a Latin quotation or classical anecdote, Burton follows Francis Bacon.[38] And in his framework of "partitions," "sections," "members," and "subsections," he imitates the scientific parlance of the day.[39]

Burton's work, unlike Duarte's, is a scientific treatise on melancholy, based on the best medical knowledge of his time.[40] The parallels in their treatments of melancholy are, at best, coincidences. Burton may have "pillaged all known books," as Legouis and Cazamian would have it, but the *Leal Conselheiro* was unknown to the anatomist of melancholy.

35 Jordan-Smith, p. 23.
36 *Ibid.*, p. 23.
37 Tucker Brooke, p. 597.
38 *Ibid.*, p. 597.
39 *Ibid.*, p. 597.
40 Sir William Osler (*op. cit.*, p. 183) called it "a medical treatise, the greatest indeed written by a layman."

Plato's Concepts of Medicine

LESTER S. KING*

PLATONIC writings abound in references to medicine, medical doctrine, physicians and their skills, doctors and their patients. This wealth of allusion is for the most part illustrative, serving to render some philosophical doctrine more vivid, concrete, and appealing. To be sure, in the *Timaeus* we find an extensive and formal exposition of anatomy and physiology, as if Plato were writing a miniature medical textbook. But elsewhere in the Dialogues the references to medicine are of informal character, serving now as a figure of speech, now as illustrative comment.

It is possible to collect and examine all these references, treating them as source material to be added to the corpus of Greek medical writings.[1] This could help us reconstruct, more or less, the practice of medicine in both its concrete and theoretical aspects, as it obtained in the 5th and 4th centuries B.C. Such compilation treats the writings of Plato as if they were a vast pudding, in which were embedded many delectable raisins to be extracted, rinsed off, and stored away. We can, however, gain a different sort of insight by attending to the pudding rather than to the raisins. We can study the relation of Plato's philosophy to the medical practice of his day. Thus, instead of dealing with the medical aspects of Platonic writings, we can analyze the philosophical aspects of Platonic medicine.

The medical lore in Plato, considered in a narrowly historical aspect, shows a great deal of rubbish and a few flashes of medical insight still approximately valid today. However, if we neglect the specific content of parochial and outworn theories, we encounter problems of universal scope which found one answer in Plato's day and which are still insistent, still calling for an answer today.

We will confine our analysis to two major headings: the status of medicine as an art and science, and considerations of medical ethics. Plato did not divide his philosophy into categories. He did not segregate his thinking and writing into texts on ethics, or politics, or logic, or philosophy of science, or metaphysics, or

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1 Osler, Sir William. Physic and physicians as depicted in Plato. In: *Aequanimitas*. 3d ed. Philadelphia, 1932.

esthetics, as separate branches of knowledge. Instead, his philosophy is an approximate unity. Consideration of any single problem calls up a deep range of overtones, reverberating and extending over his entire system. We cannot understand the part without having some insight into the whole.

I

For Plato medicine was an art. There is a famous, oft-quoted, and frequently misunderstood passage from the *Gorgias*,[2] that "medicine is an art, which attends to the nature and constitution of the patient, and has principles of action and reason in each case." "Art" in this context has no relation to the "fine arts," but is closer to what we comprehend today as *crafts*. The original sense of the term is preserved in our word, artisan.

The art of medicine Plato considers in two different senses. One is exalted and idealized, the other, more practical and mundane. In analyzing the more exalted meaning, he makes a sharp distinction between a true art and a sham. In the early part of the *Gorgias* he approaches this problem through an analysis of rhetoric, the subject taught by the professional itinerant teachers called Sophists. To the Sophists' claim that rhetoric is an art, Plato makes vigorous objection, putting the words into the part of Socrates as interlocutor. Rhetoric, instead of being an art, is only a sham, or imitation, or, in the translation of Jowett, a "flattery," because it deals only with appearances. The true art deals with reality. The nature of reality is the keystone of Plato's philosophy.

Plato distinguishes the art of the soul and the arts of the body. Our present purpose concerns the latter. The arts of the body are two: gymnastic and medicine. By gymnastic Plato seems to mean not only the modern sense of suitable exercises but, more broadly, a sound, hygienic regimen which aims at developing and maintaining states of health. Medicine, in contrast, pertains to curative and restorative functions by the use of drugs, endeavoring, apparently, to eliminate disease after it has already been established.

Contrasted to the true arts are two corresponding shams or "flatteries." Instead of health produced by the rigors of gymnastic, there is the false appearance bestowed by cosmetics and adornment or, in Jowett's translation, "tiring." In opposition to the true art, the sham is "knavish, false . . . working deceitfully by the help of lines, and colours, and enamels, and garments, and making men

2 *Gorgias*, 51 a.

affect a spurious beauty to the neglect of true beauty which is given by gymnastic."[3]

Medicine also has its opposite or sham which Jowett designates as "cookery," Taylor preferring a term like confectionery. Whereas the physician, who has the good of the body at heart, will prescribe medicines that, even if unpleasant, will aim at the cure of disease and the well-being of the body, the confectioner will try merely to please the palate, regardless of the real good of the body. The confectioner (perhaps we should use the term charlatan) "simulates the disguise of medicine, and pretends to know what food is best for the patient."[4] But this is only a specious appearance which "pretends to be that which she simulates, and having no regard for men's highest interest, is ever making pleasure the bait . . . it aims at pleasure without any thought of the best."[5]

Here, applied to the field of medicine, we have one of the cardinal doctrines of Platonic thought, the distinction between appearance and reality, and the insistence that pursuit of reality is of more value than pursuit of appearance, however pleasant the latter may be. Reality is the good, and the good of the individual's body is his health. Medicine and gymnastic concern the "real" health of the individual, while confectionery and cosmetics care only for the outward appearance, the transitory pleasure, the immediate appeal. The physician and the gymnast make the body sound, agile, healthy, while the shams produce only a disguise to cover up bodily defects. The latter process may be more pleasant, but appeals only to children or the intellectually undeveloped.

On the more mundane level, considering the physician in his practical everyday activity, the art of medicine is merely one among many, such as cobbling and carpentry. Were Plato alive today, he would most certainly have included as arts the activities of electrician, radio repair man, and automobile mechanic, along with those of the doctor. In this plane of discussion we do not distinguish between Arts and Shams with capital letters, but between the exact and less exact arts. But first, what is an art, with a small letter, and what is the common thread among all of them?

An art, for Plato, had two components, one the accurate quantitative aspect that relies on measurement, mathematics, and law. This, in Plato's terms, is embraced by the concept of "measure." The second component is more or less glorified guesswork. Thus,

[3] *Ibid.*, 465 b.
[4] *Ibid.*, 464 e.
[5] *Ibid.*, 464 e–465 a.

in the *Philebus* we find the passage, "If arithmetic, mensuration, and weighing be taken away from any art, that which remains will not be much . . . the rest will be only conjecture, and the better use of the senses which is given by experience and practice, in addition to a certain power of guessing. . . ."[6]

In any art the rational ingredient, which concerns measure and quantitation, is capable of being grasped by reason and is based on the "eternal forms" or "ideas" for which the Platonic system is famous. The residue is sheer empiricism, rule of thumb, which can be improved by practice and effort, but which is not founded on reason. Instead, it is the realm of opinion rather than of knowledge.

In Platonic terms, medicine as an art is in the same category as husbandry, and piloting, and generalship, and music.[7] These are the less exact arts and fall behind the more exact, like shipbuilding and housebuilding. These latter, which utilize instruments of relative precision, have a greater degree of accuracy than the former. Probably, were Plato writing today, he would advance medicine, because of its greater use of precision instruments, so that it would rank with shipbuilding. Not that there is any virtue in the use of instruments for their own sake, but the use of instruments allows for greater exactness, a greater measure, and consequently a greater degree of reality.

Reality for Plato is the world of forms or ideas which are grasped by reason, not by sensation or sense-perception. In discussions of the Platonic ideas there is much diversity depending on the bias of the expositor. Those who, like Popper,[8] are unfriendly to the concepts of Plato, can describe the world of ideas to sound like the veriest absurdity. If sufficiently literal, it is possible to find warrant for almost any exposition. It is possible, by judicious quotation, for example, to depict Plato's ideas as impalpable models of the things we find in the world of sense. We can think of Heaven as furnished with a collection of rust-proof, industructible, but invisible and immaterial, models of all the things in the sensible world. These models are like dies, which, when placed in the appropriate press, and the celestial machinery set into motion, will stamp concrete, perceptible objects out of formless matter. These forms or dies are admittedly immaterial but nevertheless seem to have a material flavor, like the spiritual-

[6] *Philebus*, 55 e.
[7] *Ibid.*, 56 a.
[8] Popper, K. R. *The open society and its enemies.* London, 1952. *passim.*

istic ectoplasm. Somehow it all calls to mind the notion of an immaterial assembly line whose tools and basic materials have no dimensions. Somehow this ethereal assembly line yields material objects at its terminus, much as an automobile might materialize very suddenly, after a long trip on an impalpable assembly line.

Granted that this is an exaggeration of one school of exposition, nevertheless this line of thought can be supported by judicious quotations, especially from the *Timaeus*. Plato's basic concepts, however, find a ready and more sympathetic interpretation if we regard the "idea" or "form" not as a stamp or mould, but as a *relationship,* which may be simple or complex.

The nature of relationship is best seen in mathematics. In trigonometry, for instance, a sine or a cotangent is not, in any sense, a *thing,* but is a relationship obtaining between the boundaries of an angle. A circumference is a relationship between a line called a radius and a constant called π. A line, indeed, is not material but is a particular relationship between two points. In medical terms, inflammation, for example, is a definite relationship between blood cells, blood fluids, walls of blood vessels, interstitial tissues, various substances designated as irritant, and so on. The inflammation does not consist of the red cells, nor of leucocytes, nor of blood vessels, nor of connective tissues, but in the pattern or relation which obtains among them all. Just as in a melody we have a combination of tones in a pattern, so too in inflammation we have a definite pattern or form, which constitutes the inflammation. In comparable fashion in mathematics a relation between two lines constitutes a sine.

In the older more conventional terminology the concept of inflammation is "abstract" and "supra-sensible," and can be grasped only by the "mind." We can see an abscess or a cellulitis as a concrete example of inflammation, but the concept or "form" of inflammation is "intellectual" or "rational," not "sensible."

The Platonic world of ideas is the aggregate of the relationships, concepts, definitions, "laws," and generalizations which can be grasped only by "reason." Modern science is basically Platonic, trying to discover the relationships which exist in the world around us and to express these in a manner that we can call a law, that is, a timeless, incorruptible, eternal relation or "form."

The obvious objection arises in regard to medicine, that any scientific generalization is approximate only, that any enunciated law is not perfect, changeless, or eternal. Not only is it approximate only, but it is strictly limited by context and circumstances. These

obvious and valid objections, however, merely emphasize that science aims at an "ideal" which will never be attained. Any generalization, even if seemingly precise, is merely a first, or second, or third, or higher approximation. The struggle to attain generality implies that there *are* specific and exact relationships, which our empirical analyses may approach asymptotically. The entire presupposition of science is the existence of precise relations which we attempt to discover. The scientist will draw a perfectly smooth curve to express his generalizations, even though his experimental data may not fall on the curve. This drawing of a perfect curve is the ideal generalization expressed as a mathematically perfect relationship. It is the essence of Platonism.

In good Platonic fashion medical science, like any other form of science, will disregard the concrete and particular in the search for the abstract and universal. It is not *this* guinea pig or *that* monkey which is of importance, but rather the essence of guinea-pig,[9] the guinea-pig-ness which happens to be represented in this particular 250-gram animal with a white nose. And if it were not this one, then it could be a 255-gram animal with black ears. The scientist is concerned with reaction of guinea-pig-ness to a virus or a bacterium or a toxin. The medical scientist, starting with concrete particulars, tries to transcend them, to arrive at Universal Forms or Relationships. He tries to reach generalizations in which the particulars are merely points on a curve. It is the curve or graph, which expresses a relationship of general validity, that is of importance. Plato could ask no more of a philosopher than that he start from a particular and ascend to the universal which that particular might exemplify. The philosopher might not succeed in fully grasping the universal, and the scientist might not succeed in formulating a perfect generalization. But Plato and the modern scientist both believe in the perfect universal as real. To discover, say, a 98 per cent cure rate for a disease is reasonably good medicine. But ideal science aims at 100 per cent, and this is the perfect, eternal, immutable *form* of Platonism.

Our current distinction between medical science and medical practice did not exist in Plato's day, but nevertheless his philosophy provides an admirable framework into which such a distinction may be fitted. What we call science today is the pursuit of knowledge, in the specialized sense used by Plato. Knowledge concerned the real and the universal, and the attainment of knowledge was

9 Demos, Raphael. *The philosophy of Plato*. New York, 1939. Pp. 181-2.

the goal of philosophy. There are no definite or exact rules for the acquisition of true knowledge, but certain general procedures could be indicated. In terms of modern thought those procedures for achieving scientific knowledge go by the term of "scientific method." This we like to consider as a product of the Renaissance which unshackled us from the fetters of arid philosophy. But such interpretation is quite erroneous. Plato appreciated and expressed the general factors which go to make up our modern concept of scientific method. The medical scientist engaged in any problem—for example, the study of infectious disease—could wholeheartedly adopt the following: "The right way is, if a man has first seen the unity of things, to go on with the inquiry and not desist until he has found all the differences contained in it which form distinct classes; nor again should he be able to rest contented with the manifold diversities which are seen in a multitude of things until he has comprehended all of them that have any affinity within the bounds of one similarity and embraced them within the reality of a single kind."[10] Here we have the goal of science, to seek the unity that underlies apparent diversity, and to persevere until exceptions disappear into representatives of a more general rule or law.

The principal advance of modern science over Plato lies not in the goal, nor in the method broadly conceived. The difference lies in the actual techniques employed to achieve the discrimination and unification. Plato stresses "measure," but not the detailed experimental processes that gained special impetus with the Renaissance. But we must not confuse "scientific method" with "experimental method," nor consider them synonymous. The latter is simply a special case of the former, a matter of tactics rather than of strategy.

The science of medicine, pursuing and achieving knowledge, we connect with the practice of medicine, which we think of as the application of knowledge. When we deal with the concrete and the particular, we apply the laws or forms achieved by medical science. Insofar as the practice of medicine is based on law, to that extent is it knowledge and a true art. But insofar as the practice is ignorant of the laws involved, it is a lesser art, and a matter of opinion rather than knowledge. What we call empiricism in medicine, Plato calls opinion. Opinion may be *right,* but it can be a very low form of art unless it has a rational basis. Today it is "unscientific" medical practice to achieve a successful result without knowing how or why.

10 *Statesman,* 285, b. Cf. *Republic,* 490 b.

II

Plato's views on medicine as an art and a science are quite consonant with our present-day concepts. Indeed, our modern attitudes stem quite directly from his philosophy. But in the matter of medical ethics the case is somewhat different. The modern physician who tries to follow the ethical teachings of Plato will speedily encounter a conflict of loyalties and a frustrating sense of disharmony. It is rather ironical that Plato, who was so influential in shaping the teachings of the Christian church, should nevertheless fail as an ethical guide for medical practice.

Although the problems of medical ethics are multiple, only two are discussed in detail by Plato, namely, the obligations of the physician towards his patient, and the obligations toward society. In regard to these there is a certain contradiction, an internal disharmony which cannot be resolved to our present-day satisfaction.

Plato seems to interpret the term physician rather strictly to mean the individual who is not only skilled in the art of medicine but who practises correctly. The healer who makes a mistake is not a physician; ". . . we say that the physician or arithmetician or grammarian has made a mistake, but this is only a way of speaking; for the fact is that neither the grammarian nor any other person of skill ever makes a mistake insofar as he is what is name implies; they none of them err unless their skill fails them, and then they cease to be skilled artists. No artist or sage or ruler errs at a time when he is what his name implies."[11]

The physician is an artist in the sense discussed above. Every art has a subject matter, and the aim of every art is the perfection of this subject matter. Every art must consider only the interest of its subject matter which, in the case of medicine, is the cure of the body. The physician, as a physician, has no other care. Plato argues most vigorously that "no physician, insofar as he is a physician, considers his own good in what he prescribes, but the good of the patient."[12] He must consider not what is for his own interest, "but always what is for the interest of his subject . . .; to that he looks, and that alone he considers in everything which he says and does."[13]

In these passages the references to medicine are purely illustrative. Plato is primarily interested in the problem, What is Justice?

[11] *Republic*, 340 d. This speech is by Thrasymachus, not Socrates. Nevertheless, since in the text Socrates does not refute it, and since it is consonant with the remainder of the dialogue, I interpret it as Plato's own views.

[12] *Republic*, 342 d.

[13] *Ibid.*, 342 e.

and the dialogue considers the traits which characterize the ruler of a state. Plato thinks of the ruler of a state as an artist and uses the analogy of physician and patient as a cogent illustration for the proper relationship between ruler and subject. Indeed, he says, "the true physician is also a ruler, having the human body as a subject."[13] The text argues that in the sphere of politics there should be a relationship between ruler and subject comparable to that between doctor and patient wherein the doctor thinks only of the good of the patient.

In medicine the physician must not be swayed by selfish motives. Even in Plato's time the physicians were not always unselfish, and there apparently was conflict between the healing of a patient and the payment for healing a patient. Plato frequently refers to this, in insisting that the physician, insofar as he is a physician, does not concern himself with payment. The true physician is a "healer of the sick," not a "maker of money."[14] "Nor would you say that medicine is the art of receiving pay because a man takes fees when he is engaged in healing."[15] Plato emphasizes the welfare of the patient as the sole duty of the true physician. Insofar as he deviates from that goal, he is no longer a real physician.

Now the art of medicine Plato considers a good, and he distinguishes three classes of good:[16] those which are desirable for their own sakes, independently of their results; those desirable not only for themselves but also for their results; and finally those which are fundamentally disagreeable in themselves and not to be chosen for their own sake but only for the result which they produce. Medicine, intrinsically unpleasant, is in this third category. We are now faced with the problem, what *is* the desirable result which is the goal of medicine? The obvious and limited meaning, and that to which Plato adheres in the quotation given above, is the health of the patient. But this simple interpretation, which tends to equate the physical health of the patient with his ultimate well-being, does not accord with the basic teachings of Platonism. The physical health of an individual is distinctly secondary to the good of the soul, and the welfare of the individual is incorporated into the welfare of the state.

In the ultimate scheme of things, the well-being of the individual's body is not of very great moment. In the well-known passage in the *Republic*,[17] Plato ironically ridicules Herodicus who,

[14] *Ibid.*, 341 c.
[15] *Ibid.*, 346 b.
[16] *Ibid.*, 357.
[17] *Ibid.*, 406-7.

according to legend, found the way to keep ailing patients alive as valetudinarians. This luxury, of careful tending of illness, is all right for the well-to-do. But the less well-off have no time to be ill.

More seriously, Plato supposes that Asclepius originally "exhibited the power of his art only to persons who, being generally of healthy constitutions and habits of life, had a definite ailment; such as these he cured . . . and bade them live as usual, herein consulting the interests of the State; but bodies which disease had penetrated through and through he would not have attempted to cure . . . he did not want to lengthen out good-for-nothing lives, or to have weak fathers begetting weaker sons; if a man was not able to live in the ordinary way he had no business to cure him; for such a cure would have been of no use either to himself, or to the State."[18]

The arts of medicine, according to the legends in which Plato disguises his teachings, were originally not for the unhealthy or intemperate, no matter how rich they were. The art of medicine should look to the good of the whole, and must deal with the individual according to the part the individual plays in the community. The notion that the wealthy should receive better medical care than the indigent, simply because the wealthy can afford to pay, is very repugnant to Platonism. Whoever would not be a good citizen, or could not be made into a good citizen, did not deserve to be healed.

According to tradition, Asclepius was bribed into healing a rich man at the point of death. This was wrong, for wealth is not a proper weight to be placed in the scale of medical attention.

Plato couples the physician with the judge and demands of both a care for the welfare of the state. Medicine and law "will minister to better natures, giving health both of soul and of body; but those who are diseased in their bodies they will leave to die, and the corrupt and incurable souls they will put an end to themselves." As Demos points out, "Medicine is not a private relation between doctor and patient; the doctor's obligation is to the state and not to the individual."[20] This is, to our modern ears, a discordant concept, for it abases the individual and glorifies the state. We must remember, however, that the medical ethics of Plato were founded on the concept of the good of the whole.

18 *Ibid.*, 407 e.
19 *Ibid.*, 409 e–410 a.
20 Demos, *op. cit.*, p. 360.

In the consideration of problems of justice, Plato starts with the individual man, but soon shows that the nature of justice is more easily discernible in the State, which is only the individual writ large. What is applicable to the larger is also applicable to the smaller, so that by knowing what is just for the whole we can know what is just for the part, that is, the individual. In problems of medicine, as in any other art, what is good for the individual is necessarily good for the whole; and conversely, in Platonic doctrine, what is good for the whole is good for the part. The good of man, as tended by the art of medicine, is apparently physical health, and the physician as artist must promote that health. But in the broader sense, this goal is specious. The *real* good of man is the good of the whole. The care for selfishly personal well-being is a meretricious and specious good and therefore not a good at all. In this interpretation the physician is serving the patient's ultimate best interests by attending primarily to the good of society. Any conflict of goals would then be only apparent, since the true welfare must rest with the State. Here, in matters of ethics, we encounter the same dichotomy between appearance and reality, between the sham and the real, what seems and what is. The Platonic ethics rests upon the Platonic metaphysics.

Our contemporary medical ethics rejects the metaphysics of Plato, although our medical science does not. Today we consider the good of the individual in the literal sense, and we do not submerge the individual person in the all-embracing State. The physician's duty is exclusively to the man who is ill. The physician is not a judge. The true physician, insofar as he acts as a physician, pretends to no competence beyond the limited confines of his art. Today we adhere to limits which Plato disregarded and denied.

A Note on the Spanish Version of Dioscorides' "Materia Medica"

V. PESET*

IN the first issue of Volume VIII (January 1953) the *Journal of the History of Medicine* makes note of the acquisition of a copy of the *Materia Medica* of Dioscorides in the German adaptation made by Brunfels in 1543. It may not be amiss to supplement this information with a cursory review of the Castilian version which was undertaken by the famous Andrés de Laguna.[1] This book became a decisive influence among Spanish physicians, as is evident by the various editions which were printed till well into the eighteenth century.[2]

As can be seen in the explanation given by Laguna to justify his work, the task became more than one of simple translation. Addressing the reader, on page 619, he says:

> The order which I have kept in compiling the present work, friendly reader, is the following. Firstly I tried to bring to light all the Greek works of Dioscorides, both in print and in hand writing, which I managed to discover in Italy. When, later, I had compared them with one another, I made the translation, following the most authentic and genuine among them, and wherever we found a conflict with other interpretations, I made a note at the margin of the page of the same passage in its original version, so that everyone could himself pass judgment on the disagreement. Once the translation was completed, to allow other countries to benefit from the results of our work, it seemed convenient to add at the end of each chapter, whenever the name of a simple medicine was given, its translation in six or seven and, at times, eight, nine and ten different languages, such as: Greek, Latin, Arabic, the Vulgate (which is the idiom used among the apothecaries), Castilian, Catalan, Portuguese, Italian, French and German. Dr. Luis Nuñez, a first rate physician and Simón de Sousa, a nonpareil among apothecaries and a most diligent investigator of simple medicines, offered their welcome help in this undertaking by acquainting me with

* Valencia, Spain.

1 *Andrés de Laguna* of Segovia, Spain (1499-1560) is a typical figure of the European medical Renaissance. He is regarded by the classical authors of Spanish medical history as the discoverer of the ileocaecal valve. His books on the past and especially his clarified versions and commentaries on Galen, Aristotle, etc., are well renowned. We are in need of an exhaustive study of Laguna, and the most extensive so far is that by Olmedilla: *Estudio histórico de la vida y escritos del sabio español Andrés Laguna, médico de Carlos I y Felipe II y célebre escritor y botánico del siglo XVI* (Edition El Correo; Madrid, 1887); but this work is mainly of an apologetic character.

2 Palau (in the *Manual del librero latino-americano,* Barcelona, 1951, vol. 4, p. 465), mentions the following: *Antwerp,* by John Latio, 1555; *Salamanca,* by Mathias Gast, 1563, 1566, 1570, 1584; *Valencia,* by Miguel Sorolla, 1626, 1636; *Valencia,* by Claudio Macé, 1635, 1651 and 1695 (with reprints); *Valencia,* by Vicente Cabrera, 1682; *Madrid,* by Domingo Fernandez de Arroyo, 1732, with reprints in 1752, 1773 and 1783.

many Portuguese terms with which I was not fully informed. Besides what has just been said, I presented, together with the names of those plants which are usually found in *Europa,* drawings of the proper shapes and structure, so that, with their help, anyone would be able to recognize these plants when he should stumble upon them. For the same reason I had printed, with care, all the drawings of my friends Andreas Matthiolo,

PEDACIO

DIOSCORIDES

ANAZARBEO.

ACERCA DE LA MATERIA MEDICINAL,

Y DE LOS VENENOS MORTIFEROS.

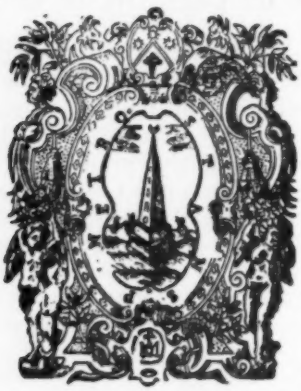
Traduzido de Lengua Griega en la vulgar Castellana, è ilustrado con claras, y substanciales Anotaciones, y con las figuras de innumerables plantas exquisitas, y raras, por el Doctor ANDRES DE LAGVNA, *Medico de Iulio Tercero Pontifice Maximo.*

Và añadida vna Tabla para hallar remedio de todo genero de enfermedades, y otras cosas curiosas, nunca antes impressa.

Y agora en esta vltima impression, corregido, y enmendado de muchos errores que tenia, conforme al Catalogo nuevo del Santo Oficio de la Inquisicion.

A LA EMPERATRIZ DEL CIELO

LA VIRGEN DE LOS DESAMPARADOS.



Con licencia: En Valencia, por el Heredero de BENITO MACE, junto el Real Colegio del Señor Patriarca, Año de 1695.

A expensas de CLAVDIO MACE, *Mercader de Libros, vive enfrente de dicho Real Colegio.*

FIG. 1

which were such a faithful and intelligent reproduction of the natural plants that it would be impossible to better them. To these I added many other drawings of my own, of plants which I found in the *Campaña;* and to each chapter were also added notes, not so prolix as to make their reading tedious, nor so brief as to leave out something that ought to be recorded. In my writing I was compelled to make use of some obscure terms, both Greek and Latin, which are not too well accepted in our Vulgate idiom, so to avoid lengthy circumlocutions, but I always had the intention of clarifying them in the present passage, following the order of A.B.C.

[Here the author introduces the above-mentioned terms and having explained them, says:]

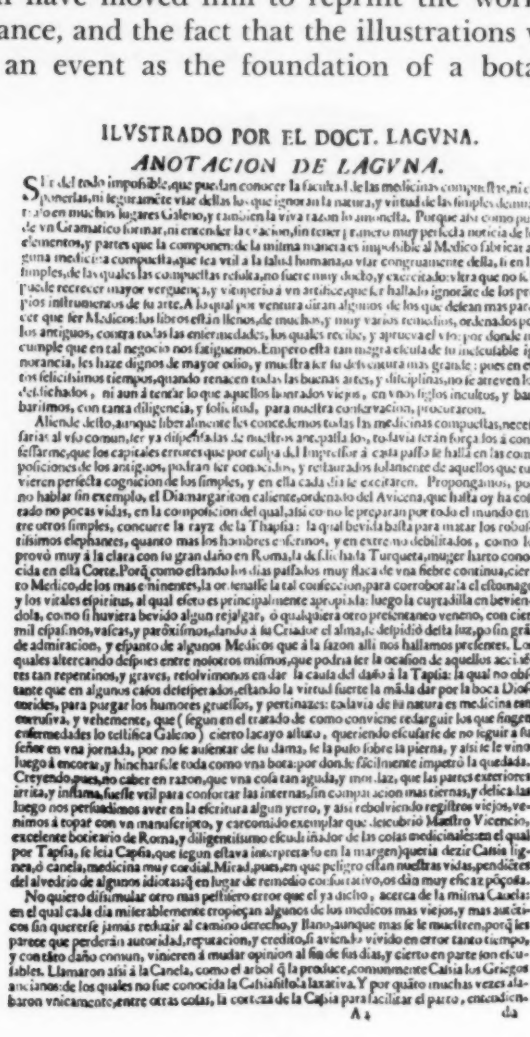
Even if my style of writing is not so elegant and clear as that used by certain writers of our time who profess to be quite lavish in their writings, this is no motive for surprise, since I have spent the greater part of my life outside the kingdoms of Spain and have therefore endeavoured in the present, not so much to embellish the written word as to explain, as faithfully as possible and with great clarity, the mysteries of nature.

ANDRÉS LAGUNA

FIG. 2

In spite of this modest appraisal by Laguna, we find his Castilian elegant and clear, qualities which contributed to a widespread knowledge of the book; it is even mentioned in the *Don Quixote*. We shall now consider how the book was edited towards the end of the seventeenth century by inspecting an edition which appeared in 1695. This belongs to a group of editions which are less well printed than the first one (published at Antwerp) or those of Salamanca. Its title-page (Fig. 1) does not have the author's picture as did the Salamanca editions (Fig. 2). After the

title-page there follow the publisher's dedicatory words to the Virgin. Next comes the same publisher's explanation of the reasons which have moved him to reprint the work; he emphasizes its importance, and the fact that the illustrations were getting lost, and such an event as the foundation of a botanical garden in



ILVSTRADO POR EL DOCT. LAGVNA. 3

ANOTACION DE LAGVNA.

Ser del todo imposible, que puedan conocer la facultad de las medicinas compuestas, ni componerlas, ni seguramente vsar dellas los que ignoran la natura, y virtud de las simples, demuestrase en muchos lugares Galeno, y tambien la viva razon lo amonesta. Porque assi como puede vn Gramatico formar, ni entender la oracion, sin tener primero muy perfecta noticia de los elementos, y partes que la componen: de la misma manera es imposible al Medico fabricar alguna medicina compuesta, que sea util a la salud humana, ni vsar congruamente della, si en las simples, de las quales las compuestas resulta, no fuere muy docto, y exercitado: viera que no se le puede recrecer mayor verguença, y vituperio a vn artifice, que el hallado ignorante de los propios instrumentos de su arte. A lo qual por ventura diran algunos de los que dellean mas parecer que ser Medicos: los libros estan llenos, de muchas, y muy varios remedios, ordenados por los antiguos, contra todas las enfermedades, los quales recibe, y aprueva el vso: por donde no cumple que en tal negocio nos fatiguemos. Empero essa tan magra escusa de su indecutable ignorancia, les haze dignos de mayor odio, y muestra ser su ventura mas grande: pues en estos felicissimos tiempos, quando renacen todas las buenas artes, y disciplinas, no se atreven los delichados, ni aun a tentar lo que aquellos honrados viejos, en vnos siglos incultos, y barbarissimos, con tanta diligencia, y solicitud, para nuestra conservacion, procuraron.

Aliende desto, aunque liberalmente les concedemos todas las medicinas compuestas, necessarias al vso comun, ser ya dispensadas de nuestros antepassados, todavia serán forçados a confessarme, que los capitales errores que por culpa del Impressor à esta passo se hallan en las composiciones de los antiguos, podran ser conocidos, y restaurados solamente de aquellos que tuvieren perfecta cognicion de los simples, y en ella cada dia se exercitaren. Propongamos, por no hablar sin exemplo, el Diamargariton caliente, ordenado del Avicena, que hasta oy ha costado no pocas vidas, en la composicion del qual, assi como se preparan por todo el mundo entre otros simples, concurre la rayz de la Thapsia: la qual bevida basta para matar los robustissimos elephantes, quanto mas los hombres enfermos, y en extremo debilitados, como lo provò muy à la clara con su gran daño en Roma, la dissoluta Turqueta, muger harto conocida en essa Corte. Porq̃ como estando los dias passados muy flaca de vna fiebre continua, cierto Medico, de los mas eminentes, la ordenasse la tal confection, para corroborar la el estomago y los vitales espiritus, al qual efecto es principalmente apropiada: luego la cuytadilla en bevendola, como si huviera bevido algun rejalgar, ò qualquiera otro presentaneo veneno, con cien mil espasmos, vascas, y paroxismos, dando à su Criador el alma, le despidió desta luz, poco sin grãde admiracion, y espanto de algunos Medicos que à la sazon allí nos hallamos presentes. Los quales altercando despues entre nosotros mismos, que podria ser la ocasion de aquellos accidentes tan repentinos, y graves, resolvimonos en dar la causa del daño à la Thapsia: la qual no obstante que en algunos casos desesperados, estando la virtud fuerte la mãda dar por la boca Dioscorides, para purgar los humores gruessos, y pertinazes: todavia de su natura es medicina con extrusiva, y vehemente, que (segun en el tratado de como conviene redarguir los que fingen enfermedades lo testifica Galeno) cierto lacayo astuto, queriendo escusarse de no seguir a su señor en vna jornada, por no se ausentar de su dama, se la puso sobre la pierna, y assi se le vino luego à encorar, y hincharsele toda como vna boza: por donde facilmente impetrò la quedada. Creyendo, pues, no caber en razon, que vna cosa tan aguda, y mordaz, que las partes exteriores irrita, y inflama, fuesse util para confortar las internas, sin comparacion mas tiernas, y delicadas luego nos persuadimos aver en la escritura algun yerro, y assi revolviendo registros viejos, venimos à topar con vn manuscripto, y carcomido exemplar que descubrió Maestro Vicencio, excelente botic ario de Roma, y diligentissimo escudriñador de las cosas medicinales: en el qual por Tapsia, se leia Capsia, que segun estava interpretado en la margen) queria dezir Canela ligna, ó canela, medicina muy cordial. Mirad, pues, en que peligro estan nuestras vidas, pendientes del alvedrio de algunos idiotas, q̃ en lugar de remedio confortativo, os dan muy eficaz ponçoña.

No quiero dissimular otro mas pestifero error que el ya dicho, acerca de la misma Canela: en el qual cada dia miserablemente tropiecan algunos de los medicos mas viejos, y mas autenticos sin quererse jamas reduzir al camino derecho, y llano, aunque mas se le muestren, porq̃ les parece que perderán autoridad, reputacion, y credito, si aviendo vivido en error tanto tiempo, y con tan daño comun, vinieren à mudar opinion al fin de sus dias, y cierto en parte son escusables. Llamaron assi à la Canela, como el arbol q̃ la produce, comunmente Cassia los Griegos ancianos: de los quales no fue conocida la Cathartica, o laxativa. Y por quãto muchas vezes alabaron vnicamente, entre otras cosas, la corteza de la Cassia para facilitar el parto, encendien-

Diamargariton caliente.

Thapsia.

Cassia.

A 4 da

FIG. 3

Valencia.[3] In the Valencian editions, the cuts are not illuminated, but on the whole the designs and the text are still preserved. As

[3] Laguna in his *dedicatory letter* to Philip II, which appears in the first editions, was already advising the foundation of such gardens, following the example of the Italian princes. His suggestion was taken up by the king who founded in Aranjuez the first botanical garden of Spain. For the rest, even though the development of botanical science in Valencia reaches its climax in the eighteenth century (Cavanilles, Lorente, etc.) it had already deserved the special attention which Laguna himself points out (cf: J. B. Peset y Vidal: *Historia de la Medicina de Valencia.* Valencia, Ferrer de Orga, 1876, pp. 101, 125 and 163).

for the former, I have had a comparison made between those found in the edition indicated above and those in Matthiolo's book.[4] Of the 643 illustrations which are found in Laguna's work, 114 are of different kind and of these 41 refer to species not illustrated in Matthiolo.

4 LIB. I. DE DIOSCORIDES.

do nuestra Canela ordinaria,q̃ al tal efecto es muy vtil: vinieron despues los Barbares,de quie[n] hablo, a dar a las q̃ parecen dificilmente, el polvo de la corteza de la Casarihola solutiva, el qual es cosa clarissimo, y muy apto para retener violentamente la criatura en el vientre, y hazer que jamas salga à luz: y de modo, que con tal recipe solo, muchas vezes perpetuamente dessomicidios,haziendo de la madre desventurada vn triste acabad de su generacion.

En ellos, pues, y en otros muchos mas enormes errores caen ciertos infortunados, que con hazer profession de Medicos,son tan ignorantes de la historia medicinal, que si le preguntais del Myrabolano que es, os dirán, que cebolla albarrana: y con todo esto los vereis andar por las calles muy ensoberuecidos, y llenos todos de anillos, como de trofeos,y despojos de los traslos q̃ derribaron: en los quales, si bien los ecuadrinais, debaxo de aquellas ropas, no hallareis sino desvergueça, y arrevinimiento, fundado en la demasiada credulidad de los populares, q̃ à qualquiera que le les vende por Medico,luego sin mas le creen,no aviendo mentira mas peligrosa en el Vniverso, ni q̃ tanto daño acarree al linage humano : de la exorbitãte improbidad delos quales procede,q̃ la Medicina q̃ en los tiempos passados tanto imperar suo à los mismos Emperadores,ande ya por el suelo tan vil,y tan abatida,q̃ qualquiera hombre honrado se abrenca de exercitar la practica de ella, cuyos professores eran celebrados antiguamente por inmortales Dioses.En ello,pues,en ello querria yo que se detuviessen los Magistrados,y los Governadores de las Republicas,digo,en conocer,y reprimir estos lobos encarnizados,y icidentes de sangre humana,q̃ disfrazados en traje de hombres,ordinariamente van por las calles, por las Cortes, y Palacios de Principes,degollando,à diestro,y à siniestro,quantos le les paran delante: en ello querria yo q̃ se ocupassen algunos ratos,como entienden en otras cosas, aunque no ellarias à la Republica, nadavia no de tanta importancia. Assi que de los tales Medicos no menos se deve huir que de la pestilencia,visto q̃ de las cõfecciones,y electuarios que no conocen,an sin duelo os arrojan ouças, y libras, como si fuessen para echar en algibes. Mas dello, entre las otras felicidades suyas,se puede alabar nuestra España,que si en alguna parte los ay,en ella cierto contiene en si muchos Medicos,y Boticarios excelentissimos,los quales harian muy grã ventaja à todos los del mundo vniverso,si con las otras gracias,y virtudes que tienen,se diessen vn poco mas a la materia medicinal,como tengo gran cõfiança que de aqui adelãte se darán bravamente à ella,pues ven muy bien quanto importa,y no son del linage de aquellos,que no solo carecẽ de doctrina tan singular, empero tambien la tiene capital odio, y aun perfiguen à los que hazen della caudal: à las quales feras solas van affectados mis tiros: pues aunque por su ceguedad, y gẽsupor se deve tener alguna compassion dellos, todavia por la cruel arrogancia,y soverbia con que andan inchados,se hazen aborrecer,y son odiosos al mundo. Tambien conviene vitar lo susodicho, advertir, que mientras podemos curar con medicinas simplissimas el enfermo, devemos siempre huir las compuestas : pues con estas le curaremos mas cõfortamente, y con mayor peligro que con aquellas,de las quales malamente podrán viar los que no las conocen.

No quiero referir al presente quantos adulterios, quantas falsedades, y embustes cada dia se hagan en las medicinas compuestas, en las quales aun los muy exercitados à las vezes se engañan, quanto mas los imperitos de la historia medicinal. Por donde hallo ser muy loable vso el de algunas Ciudades de Francia, y de Italia, adonde no se dispensara jamas composicion alguna para el vso de la Republica, sin primero los principales Medicos aver visto, y examinado todas las medicinas simples que la componen,y sobre cada vna dellos dicho su parecer.El qual instituto tambien se guarda tan estrañamente en Valencia, adonde los Boticarios son mucho mas curiosos, y diligentes que en ninguna otra parte de España. La misma costumbre prevaleció los tiempos passados en Roma,quando aquellos Augustos Emperadores tenian las riendas, y el gouierno del vniverso. Porque no eran tan curiosos,y solicitos de acrecentar los limites del Imperio,como de conservar la sanidad de los subditos. Y assi Galeno Protomedico que fue de Marco Aurelio el Philosopho, no haze fin de exaltar, y subir al cielo la bondad,y grandeza de aquellos Cesares: los quales à sus proprias costas, y expensas hazian venir de muy longinquas regiones, no tanto perlas, y oro, como medicinas exquisitissimas, para componer los antidotos, y para que nada faltasse de lo necessario à la incolumidad de su pueblo.

Valencia

Considerando pues el divino Dioscorides, quan manca fuesse la vida humana, sin la noticia particular de los simples, en los quales el era exercitadissimo, pareciole ser bien comunicar al mundo su historia: assi procurò dexarnosla muy perfecta en seys libros,visto que ninguno de los que antes fueron,ni de los de su edad, les bastò el animo à llevar al cabo tan empresta tan generosa.Para darnos,pues,sumariamente à entender la varia experiencia que tuvo a cerca de la cognicion de los simples,dize que su vida siempre fue militar. Lo qual dalo que parezca grã disparate, y en si muestre no pequeña contradicion,por que es comunmente la gente de [illegible]

FIG. 4

Having just considered how Laguna completed his work, it is easy to detect in it all the characteristics of the learned man of the Renaissance: he was an erudite philologist, a clarifier of many points of classical knowledge, an interested observer of nature, and a man of wide culture, not merely professional, but also humanistic, and these are all aspects which would be worth-while considering at length. In some passages he finds himself compelled to correct his own teacher Juan Ruelio and his friend Matthiolo, who

4 *Pet. Andreae Matthioli medici seniensis Commentarii in sex libros Pedacii Dioscoridis Anazarbei, de materia medica.* Venice, 1560.

has already been mentioned. In the present note it would be impossible to comment in detail on the private allusions in Laguna's book. We shall quote the first two pages of his notes to the preface to Book I of Dioscorides' work because we regard them as characteristic enough to give us an idea of Laguna's position (Figs.

ILVSTRADO POR EL DOCT. LAGVNA. 363

Cornelio Celso, y con él otros Escritores algunos, llamaron tambien Parthenium, y Perdicium á la Helxine, ó Parietaria.

BVPTHALMVM.

COTVLA ODORATA.

Del Bulphthalmo, Cap. 150.

EL Buphthalmo que algunos llamaron Cachia, produce los tallos tiernos, y delgadicos, las hojas como las del hinojo, la flor amarilla, mayor que la de la mançanilla, y semejante á vn ojo, de donde le vino el nombre. Nace por la campañas, y en torno de las Ciudades. Sus flores majadas con cerote, refuelven las inchazones, y las durezas. Dizese, q̃ bevida en faliendo del baño esta yerva, restituye su natural color por espacio de tiẽpo, á los enfermos de la ictericia

Grieg. Buphthalmos. Lat. Buphthalmos, & oculus bubulus. Bar. Bibar. Cat. Mançanilla loca, y ojo de buey. Cat. Vll de bou. It. Occhio de bove. Fr. Oeil de de beuf. Ted. Kinsfeane. Por. Pampilaos.

AViendo tratado Dioscorides del Parthenio en el precedente capitulo, quiso tratar del Buphthalmo en este presente, la qual planta se llamò assi, porque haze las flores semejantes á los ojos de buey. Muestranos por el Buphthalmo vnos Herbolarios vna, y otros otra planta diversa: dado que el que quisiere ser juizio pronunciará muy aseguradamente, que assi como la Cotula fetida parece ser vna especie del llamado Parthenio, ni mas ni menos la Cotula dicha vulgarmente. Non fetida, es tambien especie del Buphthalmo que aqui se trata: por el qual Andreas Mathiolo entiende essa planta que dauos pintada, la qual haze las hojas como el Abrotano hembra, y assi el cerco, como el boton de su flor perfetamẽte amarillo. Pero conviene advertir, que quando dize Dioscorides, que es la flor del Buphtalmo amarilla, no entiende de todo el boton de grumedio, y no de las hojuelas del eurorno las quales verdaderamente son blancas, y assi vemos que Galeno, y todos los que del Buphthalmo hablaron, compararon siempre su flor á la de la Mançanilla simplemente hablando salvo que la hizieron mas grande. Por donde podemos considerar, que el Buphthalmo tiene las hojuelas de entorno blancas, mas la Mançanilla toma la absolutamente, no siguifica la q̃ tiene la flor amarilla por todas partes, sino la comũ, q̃ teniendo los rayos de su redondez muy blancos tiene amarilla la cabeçuela. Digo pues en suma, q̃ el Buphthalmo es la ojuelada, ó no hetida la

Cotula

Nombres

Autoridad de Laguna.

FIG. 5

3 and 4). In them will be found his diatribe against doctors of the common sort; the mention of the *Thapsia;* his preference for the simpler medical treatments as against the practice of the dominating polypharmacy, all of which remains very significant indeed.

As a sample, we include also an engraving (Fig. 5); the illustration of the *Bupthalmum* is by Matthiolo and that of the *Cotula odorata* is by Laguna. By reading the text one will understand the necessity for this comparison.

LAGUNA'S NOTE*

That it is altogether impossible for those who ignore nature and the effectiveness of simple medicines to be capable of knowing the power of compound medicines, of making them up and even using them without many risks, is frequently shown by Galen, and good reasoning itself tells us so. Therefore, as a grammarian cannot form or understand a sentence without first having a perfect acquaintance with the elements and parts which go to form that sentence, in the same way it is impossible for a physician to prepare any compound medicine which could be of use to bodily health, or even make convenient use of it, if he be not acquainted and experienced in the use of the simple medicines from which the compound ones are derived. And to all this we add that greater shame and reproach could not fall on a craftsman than to be found ignorant of the tools of his art. But some who would falsely pretend to be doctors will perhaps answer that the books are crammed with the mention of many and distinct remedies, which have been classified by the ancients, against all kinds of ailments, and experience confirms and approves their use, therefore they think it quite unnecessary that they should trouble themselves in the matter. However, such a feeble excuse for their unjustifiable ignorance makes them deserving of far more dislike and shows how much greater is their misfortune; and so in this most happy age, while all the good arts and disciplines are reborn, these wretched creatures do not even dare attempt to do what those honest and ancient practitioners attempted, with such diligence and care for our benefit, in an age which was unlearned and unpolished in the extreme.

Even though we generously accept all compound medicines, necessary for the common use, as having been prepared by our ancestors, nevertheless we must point out that the important mistakes which, because of a printer's error, are often found in the prescriptions of the ancients, can be made known and corrected only by those who have had a perfect knowledge of the simple medicines which they have handled every day. To give you a clear example, let us consider the warm Diamargariton which was prescribed by Avicenna and which to this day has cost many lives through its preparation (and the same occurs with the Thapsia root, as it is prepared everywhere). If drunk, it is potent enough to kill the strongest elephant and so much more any sick man who is in his weakest condition—and this was clearly proved in Rome to her own loss, by the unfortunate Turqueta, a woman known well enough in this court. She had been for some days weakened by a continuous fever, and a certain very eminent doctor prescribed for her such a remedy that would strengthen her stomach and her vital spirits, for which effect, in fact, it is principally administered. She therefore drank it and, as if she had drunk realgar or some other quick working poison, she was the victim of a hundred thousand spasms, faintings and paroxysms. She departed from this life, delivering her soul to her

* Page 3 in Dioscorides' preface to his first book (p. 1).

Creator, not without incurring the great admiration and terror on the part of some doctors who had been gathered there with me at the time. We then, disputing among ourselves on what could be the cause of so sudden and severe fits, decided to blame the Thapsia for her death, for in certain desperate cases Dioscorides ordains that it should be taken orally when one's disposition is strong enough, so that it will act as a laxative on obstinate and serious humours. Nevertheless, by its nature, it is such a corrosive and effective medicine, that (as Galen narrates as a proof in his treatise about the ways of exposing malingering persons) once a cunning servant, who had no desire to follow his master on his journey but wished to remain near his young lady, sought therefore an excuse and placed this medicine on his leg which in time hardened and swelled up like a boot; of course he succeeded in staying behind. And so believing that it did not make sense that such a strong and corrosive medicine that irritated and caused inflammation when used externally could be used to cure internal sickness (which is without a doubt, of a more delicate and sensitive nature), we immediately persuaded ourselves there was some mistake in the written prescription; so after having consulted old books, we came across an abandoned manuscript which had been discovered by Maestro Vicenzio, an honorable apothecary of Rome and also a most diligent investigator of things relating to medicine. In this manuscript, instead of finding Thapsia, we read Capsia, which, as indicated in the interpretation found in the note on the margin of the page, meant "Cassia lignea" or cinnamon, which is a very invigorating medicine. So you can understand in what danger our lives are when they depend on the will of certain idiots who, instead of giving you the antidote that can heal, give you a very strong poison.

I do not wish to overlook another error even more obnoxious than the one mentioned about the cinnamon, a mistake which every day some of the older and more genuine doctors unfortunately make, without ever wishing to follow a straight and simple path, however much their mistake is evident, because they fear they will lose authority, reputation, and confidence if, after having lived such a long time in error and caused so much harm among us, they were to change their views at the end of their days. In a sense, they are certainly justified because the ancient Greeks, who were not acquainted with the Cassiafistola laxativa commonly called the cinnamon and the tree that produces it, Cassia, many times merely commended the bark of the Cassia for its use in facilitating child birth, thinking it to be our common cinnamon which is effective when put to such use. So when the barbarians, of which I have spoken, came along, they administered to women who are prone to give birth with some difficulty the powder, ground from the bark of the "Cañafistola solutiva," which has astringent faculties and is more effective in holding back forcibly the child in the womb and preventing it from ever being born; thus with such a prescription two murders are often committed at the same time, making of the unfortunate poor mother a sad coffin for her unborn child.

Therefore certain luckless people fall into this and in many other more serious mistakes; persons who, following the doctor's profession, are so ignorant of medical history that if you should ask them what the Myrabolanum is, they will tell you that it is squill. Notwithstanding this, you will see them walking very presumptuously about the streets, and wearing many rings as though they were trophies and spoils of their sad victims; and if you scrutinize them carefully, you will find under their clothes nothing but shameless daring which finds its sustenance in the gullibility of common people who are ready to take in anyone who offers his service as a physician: under the sun there is no more dangerous lie, nor one that carries with it so much harm to the human race. Because of their enormous lack of honesty it so happens that the science of medicine, which in earlier ages was wont to rule even over the emperors themselves, now goes about the earth so abject and discouraged that any honourable person would blush to follow the practice of that art whose practitioners were once considered as immortal gods. I should like, therefore, the magistrates and statesmen of all countries to exercise watchful care in these matters; by that I mean that they should endeavour to find out and repress these wolves who have taken on a human body and, dressed therefore like men, go casually about the streets, the courts, and the palaces of princes, destroying left and right whoever gets in their way. I wish some attention could be given sometime to this matter, just as much as is given to other matters of the country that call for urgent treatment and which are of less importance. So one must run away from such doctors as one does from the plague, because they administer without any scruples such amounts of prescriptions about which they know nothing, as if they were meant to be thrown into an empty well. In regard to this matter, we can praise our country Spain, among its other successes, for even if some of these practitioners are to be found here, there are certainly in its lands many doctors and very honourable apothecaries who would be of great benefit to all other doctors in the world if, among the other gifts and virtues with which they are endowed, they dedicated themselves a little more to matters appertaining to medicine; and since I greatly trust that from now onwards they will bravely do so, they can see very well how important it is, for they do not belong to that class of persons who not only lack the faith in such an important study, but are also against it and even persecute those people who dedicate their lives to its practice. My blows are directed only to these wild beasts; and even if it is proper that we should feel some pity towards them because of their blindness and their stupor, nevertheless they make themselves despised and hated by everyone through the cruel arrogance and pride with which they vainly walk about. Besides what has already been said, it is well to remember that in so far as we are able to cure a sick man by merely employing the simplest medicines, then we must always avoid the compound ones, because with the latter we would be curing him at a

greater cost and risk than with the former, which anyhow will be put to a wrong use by those who have no idea of their nature.

I do not want to refer here to the many adulterations, to the many falsifications and frauds that are daily performed when preparing compound medicines. Even those who are most experienced in these sometimes make mistakes and so how much greater the ones committed by individuals who are unlearned in medical history. For this reason, I find most praiseworthy the practice of certain cities of France and Italy, where no compound prescription whatever is dispensed for the people's use without the more authoritative doctors having first seen and examined all the simple medicines which make it up and so passed their opinion upon each one of them. This rule is also severely followed in Valencia, where the apothecaries are much more scientific-minded and diligent than anywhere else in Spain. The same custom prevailed in ancient Rome when the great emperors held the reins of the world's government. They were not merely disposed and concerned to extend the frontiers of the Empire, but also to safeguard the health of their citizens. Galen himself, "protomédico" of Marcus Aurelius, the philosopher, does nothing but exalt and praise to the stars the excellence and greatness of those emperors who at their own cost and expenses had not only pearls and gold brought from the remotest provinces, but also very valuable medicines to help in the preparation of antidotes so that nothing necessary for the healthy life of their people would be found wanting.

Then the saintly Dioscorides considered how defective human life would be without any knowledge whatever of simple medicines, in which he himself was greatly experienced; he thought well to give his history to the world. After having noticed that no previous physician, nor any of his own age had enough determination to undertake and accomplish such a generous task, he proceeded at great pains, and with an eagerness for perfection, to set it down for us in six books. . . .

History of Blood Transfusion*

N. S. R. MALUF**

I. The Use of Blood from Antiquity Through The Eighteenth Century

"THE life of the body is the blood" (Lev. 17.11; Gen. 9:4). So vital was blood considered in early times that it was food reserved only for a jealous Deity: "Avoid the temptation of eating blood" (Deut. 12:23) "for the blood is food for the Lord; the meat only to be eaten by you" (Deut. 12:27). In ancient Egypt only the divine right of kings allowed them, when stricken with leprosy, to bathe in blood (Pliny, Nat. Hist. 26:1).

In Roman mythology there is a hint at exsanguination and reinfusion. Ovidius (43 B.C.-18 A.D.), a Roman poet, relates that Princess Medea rejuvenated the aged Prince Aeson by slitting his throat, "letting all his blood run out of him" and filling "his ancient veins with rich elixir" of witch's brew. He was then "no longer lean and sallow, for new blood coursed in his well-filled veins." Up to the seventeenth century blood was probably given exclusively by mouth; there is no proof that it was ever given parenterally. In ancient Rome the blood of fallen gladiators and wild animals was lapped up by men seeking vigor, much as the young hunters of certain contemporary African tribes lap the blood of slain wild buffalo. Italian doctors recommended the sucking of blood from the arm veins of youths for rejuvenation. A recipient of this "tonic" was Pope Innocent VIII, who, in 1492, was given a draught of blood from three youths for strength and rejuvenation.

The first detailed description of transfusion is that of Libavius. Andreas Libavius (1546-1616) of Halle in Saxony, a chemist, physician, and director of the College at Coburg, wrote in 1615:[49]

> Given, one has before onesself a strong, healthy, youth rich in spirited blood and a powerless, weak, cachectic old man scarcely capable of breathing. If now the physician wishes to practise the rejuvenating art on the latter, he should make silver tubes which fit into each other: open then the artery of the healthy person and introduce one of the tubes into it and fasten it to the artery; thereupon he opens also the artery of the ill person

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and fastens the other, female tube into it. These two tubes one fits into the other and notes herewith that the warm and spirited arterial blood of the healthy person flows into the ill person and imparts to him the fountain of life and drives away all faintness.[62]

By concluding that blood would flow from the artery of the youth into the artery of the aged man, and not the reverse, Libavius was trapped in the pitfall of assumption. Giovanni Colle (1558-1631), Professor of Medicine at Padua, suggested (1628) transfusion of blood for prolonging life,[11b] but there is no evidence that he used it. Francesco Folli (1624-1685), a physician of Florence, mentioned a procedure similar to that of Libavius. He described the insertion of a silver tube into the artery of a donor animal, this tube being connected to a cannula of bone by an isolated segment of artery.[20] He claimed having performed a transfusion on the 13th of August 1654 before Grand Duke Ferdinand II. It is probable, however, that he merely described the method to the Duke without actually carrying it out.[37, 38] Conspicuous procedures in court were usually mentioned in the writings of others, and there is no confirmation from such sources. Folli receives credit, nevertheless, for suggesting the use of an isolated arterial segment as a connecting piece. He thus not only anticipated Lower, who used excised segments of carotid artery to connect his silver tubes, but also modern surgeons who use isolated segments of artery to bridge arterial defects.

Indirect record indicates that the earliest injections into the circulation were performed in 1642 by a German horseman Georg von Wahrendorff who injected wine into the veins of his hunting dogs through small fowl bones.[11] He is stated to have treated ill dogs thus with various medicaments. In 1656, at the age of twenty-four, Christopher Wren (1632-1723) at Oxford made a vigorous dog drunk by injecting wine and beer into its veins.[11, 53] Thomas Sprat, in his *History of the Royal Society* (1667), considered Wren (Fig. 1) as "the first author of the Noble Anatomical Experiment of Injecting Liquors into the Veins of Animals. . . . Hence arose many new experiments, and chiefly that of transfusing blood. . . ."

In Germany in 1664 Johann Daniel Major (1634-1693), who had graduated from Padua a generation after Harvey, infused medicaments intravenously and suggested the transfusion of blood.[11, 62] The technique of transfusion which Major advocated was similar to that of Kimpton and Brown of Boston in the early twentieth century (see Fig. 20). He suggested a silver cylinder which had a cannula-like spout at the bottom. When the cylinder

FIG. 1. Sir Christopher Wren (1632-1723); from the painting by Sir Godfrey Kneller (1648-1723).

FIG. 2. Richard Lower (1631-1690) at the age of fifty-five.

was filled with blood, the latter would be ejected into the recipient by a piston. As anticoagulant he suggested putting a grain of volatile "staghorn salt" or "Salmiak Spirit" in the cylinder.[62] Actual transfusion of blood followed Harvey's demonstration of how the blood circulates, probably as the result of the following factors: (i) interest in the circulation aroused by Harvey's discovery; (ii) the novelty, brilliance, and clarity of Harvey's experiments; (iii) interest in scientific research stimulated by the "Invisible College," which later became the Royal Society.*

Dr. Timothy Clarke (1663), who was to become physician to the fun-loving Charles II, demonstrated infusions of various medicaments into the veins of living animals. While the experiments with the drugs were of dubious import, his transfusions into exsanguinated animals may have been more successful. His work did not appear in print until 18 May 1668—in the *Philosophical Transactions* as a letter to the Royal Society.

Birch (1756), in his *History of the Royal Society,* published entries of weekly meetings from the Journal Book of the Royal Society. These records brought out the teamwork of its members:

> May 17, 1665. It was suggested by Dr. Wilkins [a bishop and physicist] that the experiment of injecting the blood of one dog into the vein of another might be made.
>
> May 24, 1665. Dr. Wilkins, Mr. Daniel Coxe, Mr. Thomas Coxe, and Mr. Hooke were appointed to take care of injecting the blood of one dog into the vein of another; and Mr. Thomas Coxe was particularly desirous to try the changing of dogs' skins.
>
> May 31, 1665. It was ordered that the experiment of injecting the blood of one dog into another be tried at the next meeting; upon which occasion Dr. Croone suggested that a common pipe might be used for both, in order to have thereby the blood of one dog sucked out by the other.
>
> June 7, 1665. Dr. Wilkins made a report of an experiment committed to his care, viz., that a dog's belly had been opened, and out of the vena cava, there was let blood to the quantity of 5 or 6 ounces into a bladder, having a small pipe of brass fastened to it in the manner of a clyster pipe, the end of which being put into the crural vein of a bitch, there was, by pressing the said bladder, about two ounces of blood injected into that vein, but without any sensible alteration in the bitch. [This type of syringe had been used earlier by Wren for intravenous infusion of medicaments.]
>
> April 18, 1666. . . . Mr. Boyle being desired to prosecute this experiment, declared that he thought Dr. Lower would do so at Oxford.

We thus have authentic record of at least two persons, Clarke and Wilkins, one a physician, the other, a bishop and physicist,

* After the Lord Protector's death and the ascension of King Charles II to the throne, the king granted a charter to the "Invisible College" which began issuing its *Philosophical Transactions* in 1666. The work of Lower and Denis appeared in the *Transactions* that year.

who made indirect transfusions of small quantities of blood. Dr. Richard Lower (1631-1690) (Fig. 2) was to make the first direct transfusion. In his *Tractatus de Corde*[53] (Fig. 3), he wrote:

TRACTATUS
DE
CORDE.
ITEM
De Motu & Colore
SANGUINIS
ET
Chyli in eum Tranſitu.

AUTHORE
Richardo Lower, M.D.

LONDINI:
Typis *Jo. Redmayne* impenſis *Jacobi Alleſtry* ad Inſigne *Roſæ-Coronatæ* in Vico vulgò dicto *Duck-lane.* MDCLXIX.

FIG. 3. Title-page of Lower's "*Tractatus de corde.*"

And first I tried to transfer blood from the jugular vein of one animal to the jugular vein of a second by means of tubes between the two; but seeing the blood clot at once in the tube and block its own passage on account of the slow movement of the venous blood, I soon began to try another way, and guided, as it were, by nature herself, I finally determined to transfer blood from an artery of one animal into the vein of a second; and by this new device to extend the circulation of the blood beyond the boundaries

prescribed for it [Fig. 4]. [The first attempt at vein-to-vein direct transfusion was thus a failure because no pump was interposed in the outer circuit.]

Having got ready the dogs and made other preparations as required, I selected one dog of medium size, opened its jugular vein, and drew off blood, until it was quite clear from its howls and struggles that its strength was nearly gone, and that convulsions were not far off. Then, to make up for the great loss from this dog by the blood of the second, I introduced blood from the cervical artery of a fairly large mastiff, which had been

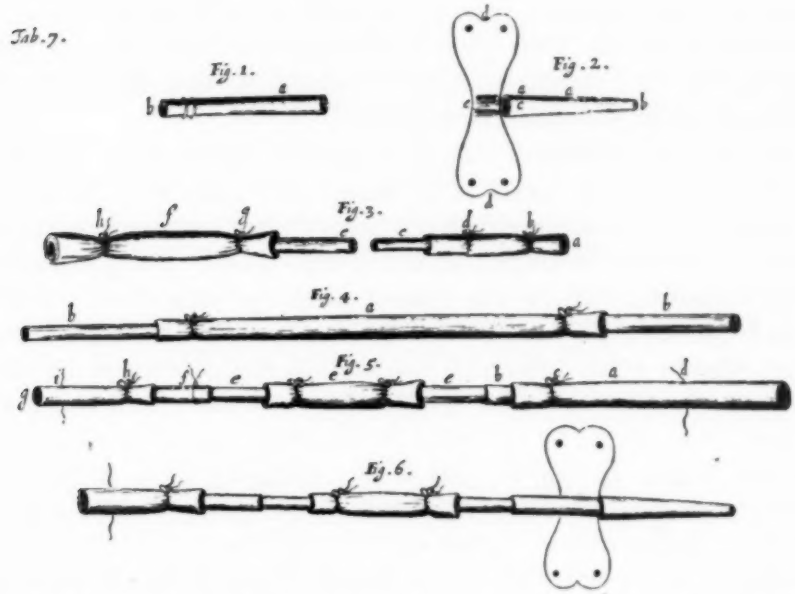

FIG. 4. Table 7 in Lower's "*Tractatus de corde*" (1669) showing the silver-tube fittings used to connect the carotid artery of an animal with the jugular vein of another.

fastened alongside the first dog, until this latter animal by its restiveness showed in its turn that it was overfilled and burdened by the amount of inflowing blood. I ligatured the artery from which the blood was passing, and withdrew blood again from the receiving dog. This was repeated several times in succession, until there was no more blood or life left in two fairly large mastiffs (the blood of both having been taken by the smaller dog). In the meantime, blood had been repeatedly withdrawn from this smaller animal and injected into it in such amount as would equal, I imagine, the weight of its whole body, yet, once its jugular vein was sewn up and its binding shackles cast off, it promptly jumped down from the table, and, apparently oblivious of its hurts, soon began to fondle its master, and to roll on the grass to clean itself of blood.

This is the first experiment on exchange transfusion, in which much of the blood of the small dog was apparently replaced by blood from the mastiffs. This type of procedure was to play a

rôle in the contemporary treatment of infants born with erythroblastosis foetalis and cases of 'temporary' acute renal failure. Lower performed the first direct transfusion in February 1665. It was not published until 1666[52] in the December issue of the first volume of the *Philosophical Transactions.*

Even though most of Lower's transfusions were homologous, that is, between animals of the same species, he did not deprecate heterologous transfusion: "For there is no reason to think that the blood of other animals mixes less well with human blood than with animal blood. This view is abundantly confirmed by recent experiments of French workers." Indeed, Lower did perform a sheep-to-man transfusion (see below).

In 1667 Dr. Edmund King,[40] another member of the Royal Society, described a direct and "easier and safer way of transfusing blood . . . without opening any artery" and outlined his method of direct vein-to-vein transfusion. He bled a calf, taking ten ounces into a container, "which was done in about 40 seconds of a minute. Then I convey'd pipes from the emittent calves vein, into the recipient sheeps vein, and there ran a good free stream of blood for the space of 5 minutes (though perhaps less swift than the first 10 ounces). And not to be deceived in the running, I did often strike with my finger the upper part of the emitting vein, and thereby felt every stroke answered on the recipient vein, just like a pulse." It is practically certain, however, that although a fluctuant, fluid impulse could be felt, little or no blood flowed from the calf's vein into that of the sheep.

The clean-cut results of Lower's experiments would suggest that transfusion is definitively a procedure to be used when there has been loss of blood. The primeval concept that a person's qualities are determined by his blood was, however, still too deep-rooted. Furthermore, oxygen had not been discovered; thus the main function of blood was unknown. Lower (1666) remarked: "'tis intended that these tryals shall be prosecuted to the utmost variety the subject will bear: As by exchanging the blood of Old and Young, Sick and Healthy, Hot and Cold, Fierce and Fearful, Tame and Wild Animals, and, that not only of the same but also of differing kinds." In his *Tractatus* he wrote that "in arthritic patients and lunatics, whose bodies are strong and viscera firm, the composition of whose brains not yet spoilt, and whose blood is not affected by putrid disease, perhaps as much benefit is to be expected from the infusion of fresh blood as from the withdrawal of the old."

On 14 November 1665, Samuel Pepys (1633-1703) mentioned an experiment, told him by Dr. William Croone (1633-1684), which had been performed at Gresham College, Oxford, at the Wednesday meetings of the Royal Society. "This did give occasion to many pretty wishes, as of the blood of a Quaker to be let into an Archbishop, and such like; but, as Dr. Croone says, may, if it takes, be of mighty use to man's health, for the mending of bad blood by borrowing from a better body."

On 23 November 1667, Drs. Richard Lower and Edmund King* attempted to change a man's character by transfusion. The patient was a 22-year-old Bachelor of Theology from Cambridge, whose brain was considered "a little too warm." The transfusion was performed in Arundel House in the presence of many spectators, including several physicians. An antecubital vein in the man's arm was cut open and six to seven ounces of his blood were allowed to run out. The patient was to be given the blood of a docile animal. The proximal portion of a sheep's carotid was cannulated with a silver tube; a similar tube was inserted into the man's vein; both silver tubes were connected by quills.

> The blood ran freely into the man's vein for the space of two minutes at least; so that we could feel a pulse in the said vein just beyond the end of the silver pipe . . . that the blood did run all the time of those two minutes, we conclude from thence. First, because we felt a pulse during that time. Secondly, because when upon the man's saying he thought he had enough, we drew the pipe out of the vein, the sheep's blood ran through it with a full stream. . . . From the quantity of blood which ran through the pipe into a porringer, we judg'd that about 9 or 10 ounces were received into the man's veins. The man after the operation, as well as in it, found himself very well.

Ten ounces were then considered a little less than 10 per cent of the circulating blood volume. Dr. Moulin* had bled various animals to death and thus found the quantity of "circulating blood" to average one-twentieth of the body weight, i.e., a 160-pound man would have 128 ounces of circulating blood. On 29 November 1668, six days after the transfusion, Samuel Pepys wrote in his diary: "I was pleased to see the person who had his blood taken out. He speaks well, and did this day give the Society a relation thereof in Latin, saying that he finds himself much better since. . . ."

* See *The Philos. Trans. and Coll. to the End of the Year 1700. Abridged.* London, 1705.

The converse experiment of trying to infect a healthy animal by transfusing it with the blood of a diseased one was performed by Mr. Thomas Coxe[12] (1667), also a charter member of the Royal Society. He transfused a sound dog with the blood of a "mangy" one. The disease was not transmitted.

Meanwhile, in France, Louis XIV (1643-1715) founded the Académie des Sciences in rivalry to England's Royal Society. Although scientists may have received but little direct inspiration from Louis, they accepted funds for experimentation and publication. Jean-Baptiste Denis (?-1704), Montpellier philosopher and mathematician, was physician to Louis XIV. In 1667 Denis[17] and Gayant[21] experimented with animals. The records are scant. Denis stated that he transfused dogs with calves' blood and that not only were all the animals well but that an exsanguinated dog had been brought to recovery by a transfusion of calves' blood. A member of the Royal Society reported the same year that he "was present when M. Gayant (of Paris) shew'd the transfusion of the blood, putting that of a young dog into the veins of an old, who two hours after, did leap and frisk; whereas he was almost blind with age, and could hardly stir before."

Denis and his assistant, Emmerez, received dubious credit for first transfusing blood into a human being—this in Paris in the middle of June 1667. The transfusion from sheep to man by Lower and King occurred in the wake of Denis' announcement. Denis apparently did four human transfusions. His first was into a youth with an obscure fever who had been depleted of blood by repeated venesection. The youth is said to have recovered from his exhausted state following the transfusion of nine ounces of blood from the carotid artery of the sheep (see *Philos. Trans.*, 22 July 1667). His second transfusion was on a healthy, paid volunteer. He had now begun to arouse the opposition, jealousy, and dislike of French physicians. His third transfusion was into a moribund patient; it was stated that the transfusion merely delayed death a few hours.

Denis' fourth case put an end to transfusion for over a century. The patient was a 34-year-old, newly-wed male house-servant, Antoine Mauroy, who would run away intermittently from his home in suburban Paris and spend his time in debauchery in Paris. A Mr. de Montmors felt sorry for Mauroy's wife and inquired of Denis whether he could help: calf's blood, because of the gentle character of a calf, might dampen Mauroy's spirits. On 19 December 1667, at 6 a.m., the patient was transfused by Denis and Em-

merez in the presence of several physicians. The patient seemed to improve and become quieter after the transfusion of five or six ounces of blood from the femoral artery of a calf connected with his arm vein; this followed a venesection of about ten ounces. On the Wednesday before Christmas, the procedure was repeated in the presence of several physicians. This time the patient felt a sensation of heat travelling up his arm during the passage of the arterial blood through his vein; he also had pain in the region of his kidneys, an oppressive sensation in his chest, and an irregularity of his heart beat. On the day before Christmas he had nasal bleeding and dark bloody urine. *This was the first transfusion-reaction or at least the first reported.* After two months the patient again became maniacal. His wife insisted upon another transfusion.

An attempt was made to repeat the transfusion but without success because of non-coöperation from the patient. The patient died the following night. Reports were that physicians who hated Denis bribed his wife to state that the patient died during the transfusion. Denis was tried for manslaughter but exonerated. Nevertheless, influential members of the Faculté de Médecine in Paris opposed transfusion, and the procedure was made illegal. The French Parliament, ten years later, prohibited the transfusion of human beings throughout France. The Royal Society of England deprecated transfusion and it was forbidden in Rome.

In Germany some sheep-to-man transfusions were performed by Balthasar Kaufmann and Matthaus Gottfried Purmann (1648-1721). They noted no improvement in two scorbutic soldiers but "healed" a leper. Johann Sigismund Elsholtz (1623-1688), physician to the Baron of Brandenburg, also performed some transfusions and is known chiefly for his monograph on intravenous infusions, *Clysmatica nova,*[19] in which appears the first illustration of an intravenous injection into man by a syringe[11] (Fig. 5). He suggested that reciprocal transfusions between husband and wife might settle marital discord. Michael Crügener, without personal experience, and Michael Ettmüller (1644-1683), professor in Leipzig, discredited transfusions as a rejuvenating measure. In Holland, Regnier de Graaf (1688) and van Horne performed some animal experiments on transfusion.

It is probably fortunate that blood transfusion took a nap for over one and a half centuries. Ignorance of antisepsis, asepsis, and immunology would have resulted in countless disasters had bloot not clotted readily and had transfusions been frequent.

In the eighteenth century there were merely a few "feints" at transfusion. In his *General System of Surgery,*[26] Lorenz Heister (1683-1758), professor of medicine and surgery at the University

FIG. 5. The first illustration of an intravenous injection in man; from J. S. Elsholtz' *Clysmatica nova,* Berlin, 1667.

of Helmstadt, described and illustrated equipment that he considered essential for transfusion but admitted never trying it. For connecting tubes he suggested hollow cylinders of metal or bone, a segment of the carotid artery, the ureter of an ox, calf, or lamb, and even the wind-pipe of a duck (Fig. 6).

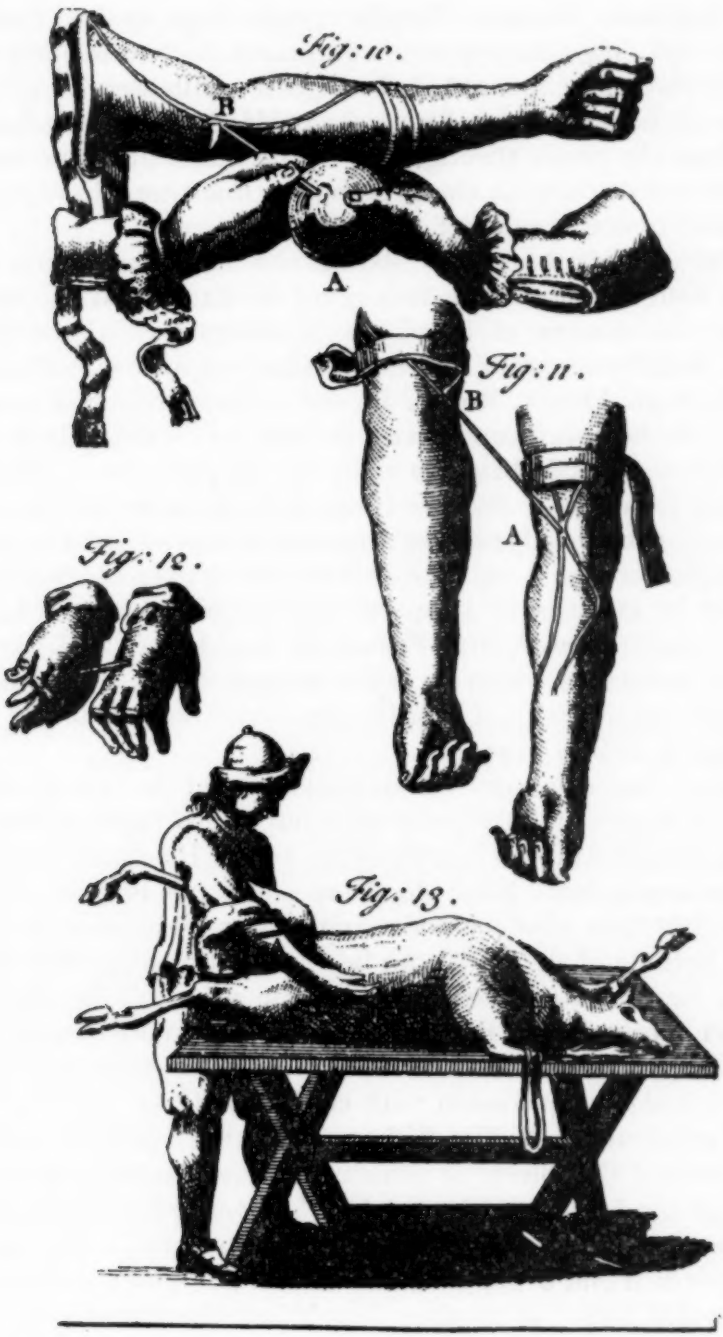

FIG. 6. Illustration from Lorenz Heister's *Surgery* (1763) showing purely hypothetical transfusions: Fig. 10. An indirect transfusion; Figs. 11 and 12. Vein-to-vein "transfusions" without a pump; Fig. 13. Transfusion from the femoral artery of a sheep into an antecubital vein of man.

In England, Erasmus Darwin (1731-1802) in his *Zoonomia* (1794-1796) suggested quaint equipment for transfusion which he probably never assembled. Two goose quills were to be united by the excised intestine of a chicken; blood was to be allowed to flow from the donor through one of the quills until the intestine was distended; then, by compressing the intestine, blood was to be displaced into the veins of the recipient.

The eighteenth century should not be looked upon as the sterile mule for blood transfusion, for in that period the most important component of blood was discovered. Without this advance, transfusion would have remained empirical. William Harvey, Richard Lower, Robert Hooke (1635-1703) and other scientists of the seventeenth century had noted that blood in the pulmonary veins is brighter than in the pulmonary arteries. It was easy to conclude that the lungs took up something vital from the air, but knowledge of the atmosphere was vague. Oxygen, the dephlogisticated air of Joseph Priestley (1733-1804), was discovered by Priestley in 1774. In 1777 Antoine Laurent Lavoisier (1743-1794) showed that Priestley's dephlogisticated air was a definite substance which he called oxygen. With Pierre-Simon de Laplace (1749-1827), Lavoisier described respiration as a combustion of carbon (1780).*

After the discovery of oxygen and of its vital necessity, Michele Rosa[11] of Italy performed important experiments under the anatomist Antonio Scarpa (1747-1832). He noted that an animal in severe shock from blood loss could not be resuscitated by serum but that whole blood was necessary. He showed that the blood volume of an animal can be appreciably augmented without harm; he increased the blood volume of a calf by about one-quarter. He believed that acute blood loss could be replaced by heterologous transfusion. In his protocols, however, two tortoises were killed by transfusion with calf's blood.

Marie-François-Xavier Bichat (1771-1802), a French physiologist, studied the effects of transfusing dark, de-oxygenated blood through the brain of animals.[6] *He thus performed apparently the first recorded cross-circulation experiments* (1805). He connected the proximal end of the carotid artery of a dog to the distal end of the carotid artery of another dog. When the donor dog was suffocated so that its arterial blood became dark, the recipient dog also became unconscious.

* An excellent brief analysis of the history of respiration is contained in J. F. Fulton's *Physiology* (Clio medica series), New York, Paul B. Hoeber, Inc., 1931. xii, 141 pp.

The brightening of venous blood when subjected to the air led to the observation of the anticoagulant effect of nitrous and other "neutral salts," because when these were added to dark red blood, the color of the blood became brighter. The English anatomist, William Hewson (1739-1774), student of John Hunter (1728-1793), noted anticoagulating effects of various "neutral salts" (1774).[28] He stated that "this property of one of the neutral salts has been long known amongst those who prepare the blood of cattle for food; for it has long been a practice with such people, to receive it into a vessel containing some common salt, and to agitate it as fast as it falls, by which means the coagulation is prevented, and the blood remains so fluid as to pass through a strainer, without leaving any coagulum behind; by this means they have an opportunity of mixing it with other substances for culinary purposes." Hewson's interest, however, in the anticlotting effects of salts was apparently secondary to his affirmation that such salts turned dark blood a brighter red. This phenomenon had caused some of his contemporaries to deduce that the atmosphere, therefore, contained "nitre." Oxygen, or Priestley's dephlogisticated air, had not yet been discovered. Thus Hewson stated that

> Some of the neutral salts have a similar effect on the colour of the blood to what air has, particularly nitre; thence some have attributed the difference of colour in the arterial and venous blood to nitre; which they supposed was absorbed from the air whilst in the lungs. But we know that this is a mere hypothesis, for air contains no nitre. Indeed, nitre is far from being the only neutral salt which has this effect on the blood, for most of them have some degree of it. In making some experiments on this subject, I have observed a more remarkable effect which some of the neutral salts have upon the blood; that is, being mixed with it when just received from the vein, they prevent its coagulation, or keep it fluid, and yet upon adding water to the mixture, it then jellies or coagulates. Thus, if six ounces of human blood be received from a vein upon half an ounce of Glauber's salt [sodium sulfate] reduced to a powder, and the mixture agitated so as to make the salt be dissolved, that blood will not coagulate on being exposed to the air. . . .
>
> I have tried most of the neutral salts, and have made a table of their effects on the blood; but it is not necessary to trouble the reader with it, as we do not see what use it could be in medicine. . . . Indeed, these experiments, as well as some others, were not made with a view of any immediate application to medicine, as to determine the properties of the blood chemically. . . . When blood is thus kept fluid by Glauber's salt, it still retains its property of being coagulable by heat, and by other substances as before, air excepted. . . .

Hewson was apparently dealing with the salting-out effects of "neutral salts" on the plasma globulins, among which is fibrinogen, because these effects were lost upon dilution. Even ordinary table

salt, added to blood in sufficient amount, prevented clotting. Among earlier workers on the effects of salts on the color and clotting of blood were Dr. Freind (1703), J. Handley (1721), and Thomas Schwenke (1743).[29]

II. ADVANCES OF THE NINETEENTH CENTURY

The nineteenth century opened with a review on blood transfusion and the intravenous administration of medicaments by Paul Scheel[74] of Copenhagen. At St. Thomas's and Guy's Hospitals in London an obstetrician, James Blundell (1790-1878), was aroused by the plight of women who went into shock and died from post-partum hemorrhage. He revived interest in clinical transfusion but performed experiments on dogs before transfusing human beings. He championed indirect transfusion and was the first to use it as the method of choice. In 1818 he published his first paper on experimental transfusion. His syringe was two ounces in volume and "air secure, made of brass, tinned internally, not offensive with oil, of course perfectly clean." The blood was drawn from the femoral artery of a dog and injected into the femoral vein of another dog.

Blundell suggested transfusion only for hemorrhage endangering life. He repeatedly showed that severely bled dogs can be resuscitated by immediate homologous transfusion. He found, however, that if he bled dogs until their breathing stopped and their blood ceased to flow, they could no longer be resuscitated even by immediate replacement of homologous blood through the jugular vein. He first submitted experimental evidence[9] that transfused blood may serve as nourishment:

> For three whole weeks I nourished a dog by the mere transfusion of blood into the external jugular vein. The aggregate quantity infused during this period was eighty-four ounces, avoirdupois, nearly; that is, on an average, four ounces a day; and during the whole time the animal was allowed to swallow nothing except water, and indeed never manifested any marked desire for solid aliment. The blood, during the first eleven days, was injected by the syringe, but during the remainder of the term it was transmitted direct from the artery of the emittent dog, by means of a tube. . . . At the end of this period I found the dog, which weighed twenty-six pounds two ounces when the experiment began, had lost seven pounds two ounces of its weight.

The animal died with an enlarged spleen and liver and a dilated right ventricle.

Blundell was the first to give clear-cut warning against transfusing with heterologous blood: "Although, however, the blood of one genus of animals may, perhaps, without fatal consequences, be sparingly mixed with large quantities of the blood of another

FIG. 7. James Blundell's transfusion chair for the donor. The receiving vessel and pump, enclosed in a water jacket, are attached to the chair by a vise. (After Blundell, 1824)

genus, all the facts which have hitherto come to my knowledge, go to prove, that if an animal be drained of the blood in its larger vessels, and replenished with large quantities of blood derived indifferently from another genus, great danger, and in general death will ensue." He mentions experiments in support of this. Thus four ounces of blood were drawn from the femoral artery

of a small dog and replaced by an equal quantity of human blood injected by syringe into the canine femoral vein. The dog died in a few minutes. This experiment was repeated several times with similar results.

Blundell[10] showed that blood may be transfused by syringe without losing its resuscitating quality: "Several dogs I have drained so that they lay in a state of asphyxia—in truth appearing

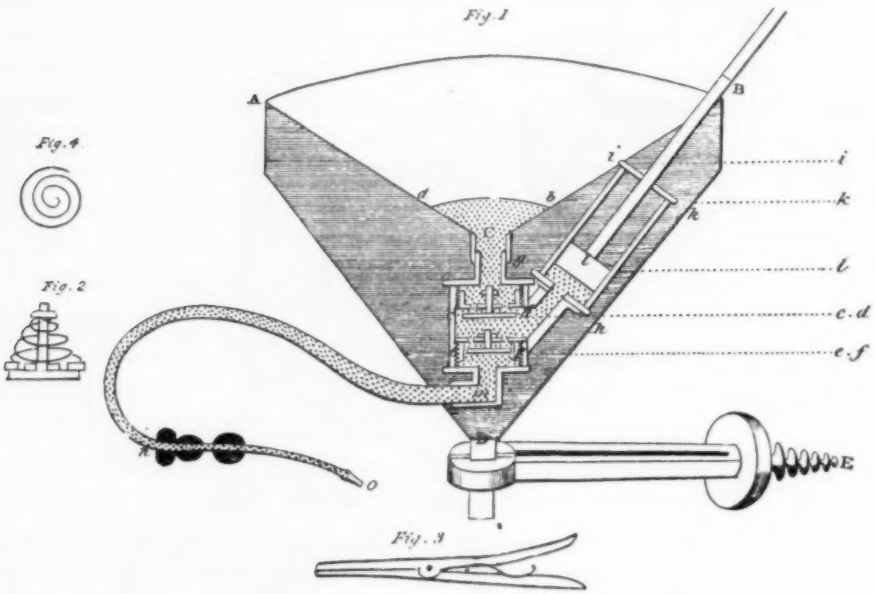

FIG. 8. Longitudinal section through Blundell's receiving vessel and plunger pump enclosed by a water jacket. Note the pair of floating valves and the vise holding the stem of the water jacket.

to be altogether dead. Dogs thus prepared, I have replenished by the use of the syringe with blood from other dogs, and they have done as well as if transfusion had been performed by means of the tube." In an ingenious experiment Blundell circulated a dog's entire blood through a pump, which he termed an "impellor" (Figs. 7 and 8) and found that the dog remained well:

> Directing towards the heart a tubule inserted into the femoral or carotid artery, and the corresponding veins, I placed near to these tubes a cup, in communication with a proper apparatus; then allowing the blood to rush from the artery into the bottom of the cup, by means of an instrument called an impellor, figured in my 'Physiological Researches,' I absorbed this fluid into the barrel of a syringe, and returned it to the veins, so adjusting the return to the eruption from the artery, that more than one ounce was

never allowed to accumulate in the cup of the syringe at one time . . . the operation was carried on for twenty or thirty minutes together, the blood rushing from the artery during the whole time, so that all the blood in the body of the animal must have passed the syringe, and this too repeatedly, the dog, however, not appearing to suffer materially in consequence.

It is odd that homologous transfusion into man came so late. Blundell *appears to have been the first to use human blood for human transfusion.* In 1824[8] he described in detail three methods of transfusing blood. The first two are direct and the third indirect:

(1) "Of transfusion from the arteries of one man to the veins of another." He suggested use of the radial, ulnar, or anterior tibial arteries, preferably the radial. Connection between artery and vein was made by fine tubes.

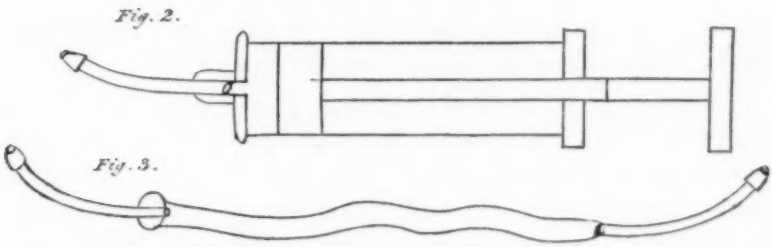

FIG. 9. Blundell's metal syringe for indirect transfusion (Fig. 2) and a connecting piece (Fig. 3). (After Blundell, 1824)

(2) "Of transfusion of venous blood by means of the impellor." The impellor (Fig. 8) was a valved syringe allowing only one-way flow and was worked manually. It was composed of an inner and outer cup; the latter was filled with tepid water at 96° F., thus preventing entry of air into the instrument by leakage of the joints or syringe. "Half a pint, or a pint of water is then poured into the inner cup and pumped briskly through the instrument so that the air may be expelled thoroughly, the water taking its place." The impellor was held erect by a vice which was very firmly screwed to the back of a chair. The donor was made to sit on the chair; superfluous water in the cup was removed by a sponge; an arm vein was opened by a lancet. The blood dripped into the cup of the impellor and, by the play of the plunger, blood was impelled directly into the vein of the patient.

(3) "Of Transfusion by the Syringe." His syringe (Fig. 9) has already been described above; it was not unlike that of Elsholtz about two hundred years earlier. Blundell suggested venesecting the donor into a conical vessel and then aspirating the blood by the syringe. Air in the syringe was expelled prior to the injection. *He tested the intravenous injection of small amounts of air into little dogs*: "I threw about five drachms (20 cc.) of atmospherical air in the direction of the heart, in quantities about a drachm at a time; the whole operation occupying about five minutes. The quantity of the air was measured by means of the syringe. In consequence

of this operation dyspnea was produced, together with irregular action of the heart; the dyspnea, however, not coming on as soon as the air might be supposed to have entered the heart, but a minute or two afterwards." The dogs survived. (Goodridge[24] has found that one to two cc. of air per kilogram of dog injected rapidly into the jugular vein is not far from the lethal dose.)

Blundell mentions five human cases in whom homologous transfusion was attempted. He adhered closely to his tenet that transfusion should be used only in dire emergency. Two of his patients were obviously dead at the time of transfusion and the other three were moribund. The knowledge of his time was inadequate to make transfusion a safe procedure; it is to his credit that he was aware of danger. He was an objective and honest worker and spoke cautiously. In 1828 the *Lancet* reported that he had performed an apparently successful transfusion on a patient. Other Englishmen such as Doubleday, Cline, Waller, and Davis followed in Blundell's footsteps but made no advances.

Two French physiological chemists, Jean Louis Prévost (1790-1850) and Jean Baptiste André Dumas (1800-1884), contributed to the knowledge of blood and its use in transfusion. They showed[70] that animals exsanguinated to the point where their breathing and cardiac pulsation ceased could not be resuscitated by intravenous water warmed to 38° C., or by serum: they could, however, be revived fully by homologous transfusion. This, however, was essentially only a confirmation of the already mentioned work of Rosa.[71] They affirmed that heterologous blood resulted in death, thus supporting Blundell, and found that infusion of mammalian blood into veins produced sudden death. They decided that death was not explicable on the basis of mechanical obstruction because the erythrocytes are smaller in mammals than in birds. Prévost and Dumas found that whipping or twirling of blood results in deposition of fibrin on the churning instrument and prevents clotting. They noted that this incoagulable defibrinated blood is as capable of resuscitating bled animals as untreated blood. Blood made noncoagulable by a small amount of caustic soda also was effective in resuscitation.

Johann F. Dieffenbach[17a] (1792-1847), surgeon at the Charité in Berlin, confirmed the results of Prévost and Dumas and noted (1828) that arterial blood could resuscitate somewhat quicker than venous blood. A "hydrophobic man," after venesection and bleeding, was transfused with three cups of blood from a healthy man. Dieffenbach (1830) transfused an asphyxiated neonate, de-

livered by laparotomy, with two ounces of venous, defibrinated blood through the umbilical vein. The infant nevertheless died. Blasius (1832) repeated the above procedure without greater resuscitative effect. Bennecke (1867) attempted to revive an asphyxiated neonate by transfusing with bright red umbilical blood into the umbilical vein. This infant survived but another, similarly treated, died.* To defibrinate blood prior to transfusions, Sir Thomas Smith (1873) at St. Bartholomew's Hospital in London used the following procedure: "a wire egg-beater, a hair sieve, a three-ounce glass aspirator syringe, a fine blunt-ended aspiration cannula, a short piece of india-rubber tubing with a brass nozzle at either end connecting the syringe with the cannula, a tall narrow vessel standing in warm water for defibrinating the blood, and a suitable vessel floated in warm water to contain the defibrinated blood."[37]

Theodor Ludwig Wilhelm Bischoff (1807-1882) of Heidelberg reinfused into animals, almost bled to death, their own blood after defibrination; recovery resulted.[7] He believed that sudden death from heterologous blood is caused by fibrin in the transfused blood. His protocols, however, contradict this viewpoint. Nevertheless, he suggested that it is advisable to transfuse human beings with human blood and to defibrinate and warm it prior to use. These men, including the anatomist, Johannes Peter Müller,[59] had found that whipping or twirling blood to defibrinate it does not alter the microscopical features of the erythrocytes.

The French physiologist, François Magendie (1783-1855), found that when avian or amphibian blood is infused intravenously into a mammal, the erythrocytes of the infused blood rapidly vanish.[55] The avian or amphibian erythrocytes were not recognizable in the blood of the recipient mammal. Charles-Edouard Brown-Séquard (1818-1894), another French physiologist, confirmed Magendie's findings and made an intensive but futile search in the recipient's body for the foreign erythrocytes one hour after transfusion (1858). A quarter of an hour after transfusion, however, the foreign erythrocytes could be seen in every vein examined. He believed he saw the foreign erythrocytes in the recipient's blood again one month after the transfusion. It was suggested that they might migrate across the capillaries of the host. The German gynecologist, Eduard Martin, transfused defibrinated whole blood with a glass syringe (1859).[62] This was a

* These three cases are reported by Landois (see ref. 43).

distinct advance over the all-metal syringe used by Elsholtz and Blundell.

Peter L. Panum (1820-1885) of Kiel made extensive experiments on blood transfusion.[65] *He replaced practically the entire blood of a dog with defibrinated homologous blood and found no change in behavior of the animal.* He endorsed defibrinated blood for human use and deprecated heterologous transfusion as dangerous except in "closely related" animals as the cow and sheep or horse and donkey. He hinted at the use of blood banks by suggesting the preservation of blood on ice. He indicated the danger of overloading the circulation and stated that only in acute blood loss is transfusion indicated without simultaneous withdrawal of blood by venesection.

FIG. 10. Franz Gesellius' (1873) technique for drawing capillary blood from a donor. The pump creates a vacuum and the multiple spicules cause multiple bleeding points. The container which receives the blood by gravity is surrounded by a warm water jacket.

Willy Kühne (1837-1900) of Hamburg published his experiments on the treatment of dogs, poisoned with carbon monoxide, by exchange transfusion.[40a] Efficacy of this treatment was apparent. Friedberg,[20a] in Traube's clinic in the Charité Hospital in Berlin, transfused a patient poisoned with carbon monoxide with eight ounces of defibrinated blood after withdrawal of an equal quantity. The patient is said to have improved, because he reacted to stimuli, yet died that evening. A similar attempt at minor exchange transfusion with only six ounces of blood was performed upon a thirteen-year-old boy with carbon monoxide poisoning; death occurred after two and a half hours.

Leonard Landois (1837-1902), professor of physiology at the University of Greifswald, demonstrated[41] with Albert Eulenburg

(1840-1917) the value of exchange transfusion in resuscitating dogs poisoned with carbon monoxide, chloroform, ether, strychnine, morphine, and phosphorus. Weber and Blasius attempted a moderate replacement transfusion in a case of leukemia without success. Neudörfer, Esmarch, and Hueter attempted the procedure in a patient with septicemia. Landois and Eulenburg confirmed

FIG. 11. Figure to the left shows Gesellius' recipient flask connected to a cannula in readiness for infusion into the vein of a recipient. Note the pump, *e*. Figure to the right shows Gesellius' recipient flask with rubber pumps and jacket of warm water attached.

and extended Blundell's experiment which had indicated that daily transfusion of blood can delay death from hunger in dogs.

Meanwhile, Franz Gesellius[23] (1873), physician and surgeon of the Royal Society of Physicians of Wilna, Poland, and Oscar Hasse[25] (1874), physician of Nordhausen, Germany, inadvertently set the clock backward by endorsing the use of sheep blood for transfusion. Gesellius was opposed to the use of defibrinated blood because he thought it relieved blood of a vital function. He devised an ingenious but obviously painful apparatus which punctured the donor's skin at many points (Figs. 10-14). The blood which dripped into a container was then transfused into the recipient as rapidly as possible.

FIG. 12. Spraying the skin with (?) ethyl chloride prior to venesection or transfusion through the cannula at the right. (After Gesellius, 1873)

FIG. 13. Drawing blood from a donor by venesection.
(After Gesellius, 1873)

Hasse recorded 15 sheep-to-man transfusions in which an average of 150 cc. of blood were transfused. A typical reaction consisted of dyspnea, cyanosis, severe back pain, malaise, unconsciousness, convulsions, severe chills, vomiting, diarrhea, coughing, wheals, and, in some cases, death. The urine became bloody and the patient eventually became jaundiced. Hasse explained the convulsions as a sign of over-activation of the patient by the animal's fresh spirits. He considered the bloody urine to result from the decaying erythrocytes of the patient. He advocated the use of sheep blood for various "incurable diseases."

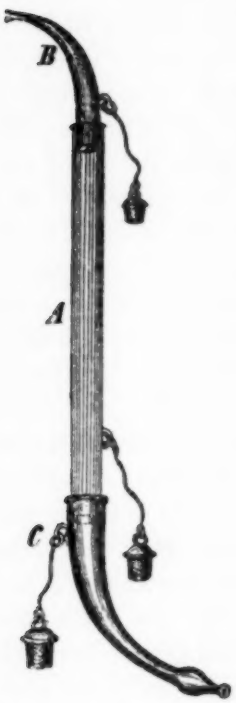

FIG. 14. Gesellius' silver cannulae, *B* and *C*, and glass connecting piece, *A*, for artery-to-vein transfusion. This was used for animal-to-man transfusions.

Emil Ponfick (1844-1913),[68,69] pathologist of Rostock and later of the University of Breslau, and Leonard Landois[42] published their outstanding investigations on blood transfusion shortly after the end of the Franco-Prussian war. They presented extensive experiments and delivered the *coup de grâce* to heterologous blood transfusion. On 28 May 1874, Ponfick read before the Association of Baltic Physicians his findings with his assistant, Dr. Bamberg, showing the dangers of heterologous transfusion. He reported the case of a 36-year-old woman in postpartum bleeding and severe shock, almost terminal, who received a direct artery-to-vein transfusion of sheep blood for one to two minutes. Twenty minutes later she died after going into coma. He claimed to have found residues of lysed erythrocytes in her serum taken at autopsy. In 1875 he published his classical paper[69] and mentions that an M. Herrmann[27] (1859) had injected distilled water intravenously into dogs and noted consequent lysis of erythrocytes. Ponfick injected defibrinated sheep blood intravenously into dogs up to 3 per cent of the canine body weight in 40 minutes. They first underwent augmented depth and frequency of breathing, then defecated and had convulsions, after which their breathing and reflexes became hypoactive and they died in two hours. He noted the following abnormalities at autopsy: cardiac chambers dilated with blood; numerous scattered pulmonary hemorrhages; intestine markedly

distended and with isolated petechial hemorrhages; numerous spotty hemorrhages in the mesentery and posterior mediastinum; both kidneys enlarged and markedly congested; the liver dark and hemorrhagic; the stomach with blood-tinged mucous, and the rectum with blood-tinged feces. There were no pulmonary infarcts and no changes in the brain and meninges. The dogs which received less sheep blood, and which thus survived long enough to urinate, had bloody urine. A dog which received 1.2 per cent of its weight of the heterologous blood died as late as 79 hours after transfusion. Similar results occurred after the transfusion of cats and rabbits with sheep blood. *Ponfick was the first to record that the bloody urine was not a hematuria but a hemoglobinuria.* He introduced the term "hemoglobinuria." By that time hemoglobin had been identifiable spectroscopically. He found the shortest latent period between the beginning of a heterologous transfusion and the appearance of hemoglobin in the bladder to be 14 minutes and the longest 82 minutes. In the longer survivals he considered the "secretory insufficiency" of the kidney as the cause of death. *He was the first to note the brown masses in the tubular lumina of dogs which had received a relatively large amount of heterologous blood* and considered that these brown masses were degraded hemoglobin, hematin. He noted that in survivors sacrificed shortly after transfusion these casts are red and that in those sacrificed later they are dark brown but are never composed of erythrocytes. The kidneys were markedly hyperemic and dark red with enormously dilated veins; there was fatty degeneration of the tubular epithelium.

Another major stride by Ponfick was the finding that *the source of hemoglobin in the urine was the donor's erythrocytes and not the recipient's*: he infused the serum of sheep into dogs up to 5 per cent of the canine body weight. These dogs did not develop hemoglobinuria.

Ponfick listed the minimum lethal dose of various heterologous defibrinated bloods for dogs as follows:

Donor Animal	*Per cent body weight of dog*
Sheep (direct transfusion; not defibrinated)	1.0-1.2
Sheep (indirect; defibrinated)	1.3-1.4
Fowl	2.0-2.5
Pig	2.0
Calf	2.0
Human	3.0
Rabbit	4.0
Cat	5.0
Duck	10.0

Almost simultaneously with the appearance of Ponfick's work, but acknowledgedly later, Landois (1875) put out his monograph on *Die Transfusion des Blutes.*[43] He was able to collect statistics on 478 authenticated transfusions up to the end of 1874. Of these, 129 were performed from animal to man: 42 patients were said by their authors to have improved or recovered; 62 showed no improvement or died, and 25 had temporary "improvement" with dubious results. The animal-to-man transfusions included those of Denis, Lower, Gesellius, Hasse, and some Germans of the nineteenth century. The symptoms, which we recognize as due to incompatible blood, were noted by Denis, Hasse, and others. There were 347 transfusions of man to man: 150 patients were "improved," 180 results were unfavorable, 12 were dubious, 3 were unknown, and 2 patients died during the transfusion. Landois recognized that jaundice which occurred in a surviving case of mistransfusion was probably due to transformation of the released hemoglobin into biliary pigments. From his numerous experiments on transfusion with heterologous blood (always animal-to-animal) he severely attacked "modern Denises"—Gesellius and Hasse. He found that the erythrocytes of sheep undergo lysis in human serum *in vitro.* Brugelmann (1874) found none of the sheep's erythrocytes in the blood of a patient to whom he had given 110 cc. of sheep blood two days previously. The patient developed hemoglobinuria. Landois could not detect the elliptical erythrocytes of fish, amphibians, and birds in the blood of a mammal a day or so after the heterologous transfusion.

Landois indicated that most of the hemoglobin, released by lysis, is excreted by the kidney rather than transformed into biliary pigment and found that the urine then contains "serum albumin" in addition to hemoglobin. He measured the concentration of hemoglobin in the urine spectroscopically; he also measured the concentration of iron in the urine and subtracted the trace of iron found in normal urine. He obtained the "serum albumin" in the urine by subtracting the urinary hemoglobin from the total urinary protein.

Landois was aware of the possibility of oliguria or anuria arising from heterologous transfusion. He found this twice in dogs transfused with defibrinated sheep blood. Like Ponfick, he regarded the cause as renal tubular obstruction by hematin casts.* The anuric dog died in 24 hours. At autopsy the kidneys were deep

* Tubular obstruction with cast and crystals precedes cellular damage of the tubules.[56]

red and rich with blood. He considered these dogs as having received sheep blood to the extent of 21 per cent of their own blood volume, calculated at one-thirteenth of their body weight. An oliguric dog received 31 per cent of its blood volume thus calculated. The result was diarrhea, bloody stools, and death. Dogs which recovered showed a diminished urinary concentration of urea, indicating renal damage. All dogs which died following heterologous transfusion had kidneys markedly congested with blood. Landois realized that renal failure as such could not, however, have been the cause of these deaths. He mentions that ligations of both ureters or extirpation of both kidneys in dogs results in death only after two days at least. An earlier death than that could not be due to uremia especially when no uremia existed. Landois believed that the primary cause of death from a heterologous transfusion was emboli resulting from release of fibrin from lysed erythrocytes.

Credit is due him for suggesting the danger of hyperkalemia from lysis of red cells as a possible contributing cause of rapid death. He described the following experiments as illustrating this factor:

A dog weighing 5.75 kg. received rapidly through its jugular vein the amount of potassium present in 100 cc. of human blood dissolved in 10 cc. of water, i.e., about 15 mEq. of potassium or the amount of potassium present in 1.1 Gm. of KCl. The dog underwent salivation and tremors and died in a few seconds. In a similar experiment the chest was opened immediately after death and the heart was found to be undergoing irregular wave-like contractions (fibrillation).

If hyperkalemia, however, were the primary cause of death in most of their heterologous transfusions, one might expect human erythrocytes, which have a higher potassium content than those of the other species, to be more lethal than an equal quantity of erythrocytes from the sheep which, according to Kerr,[36] have a relatively low potassium content. Actually, as Ponfick's table shows, the contrary seems to have existed. It is assumed, of course, that injection and lysis occurred at a constant rate, which was probably not so. Landois found that erythrocytes of sheep are much more rapidly lysed by human sera *in vitro* than are canine or feline erythrocytes. Many more disasters would have followed the use of animals' blood had blood not been a clotting fluid. If one takes for granted the actuality of the stated amounts of blood transfused, one might wonder how well the various species including

ourselves withstood heterologous transfusion. A probable explanation is that the amount of blood transfused was indeed only presumed. It was estimated thus: one measured in a given time, e.g., in 30 seconds, how much blood flowed into a container from a cannula introduced into the carotid or femoral artery. One assumed that the same volume flowed into the recipient animal when the tube was connected with the recipient's vein. Thanks to clotting, probably much less actually flowed. This crude method of measuring the amount transfused was used even at the Johns Hopkins Hospital as late as 1912.[5]

It is often presumed that intra-arterial transfusion is an ultramodern procedure. Aside from the fact that W. S. Halsted (1852-1922) used it late in the nineteenth century, C. Hueter (1870),[33] professor of surgery at Greifswald, where Landois was professor of physiology, had advocated the injection of defibrinated blood peripherally into the radial or posterior tibial arteries, thus allowing the injected blood to reach the heart more slowly and uniformly. Landois reported experimental trials of intra-arterial transfusion in 1875. In one experiment he drew 100 cc. of blood from the carotid artery of a 6-kg. dog and defibrinated it. He then clamped the trachea of the dog tightly until the dog lay completely unresponsive and had ceased to breathe. One minute after the last respiratory movement the 100 cc. of defibrinated blood were injected into the femoral artery. The dog experienced several respiratory gasps. In another experiment he injected 43 cc. of defibrinated rabbit blood into the femoral artery of a 19-kg. dog in which the ipsilateral femoral vein had been ligated. The result was gangrene and swelling of that leg; the dog died on the third day.

Meanwhile, in Germany there was an indecisive battle for and against the use of defibrinated blood. More hemolytic reactions, of course, followed the freer use of this incoagulable blood. Some ascribed these "shock-reactions" to the lysis of erythrocytes following the shaking or whipping necessary for defibrination. Others, like Neudörfer,[61] believed that the injurious effects of transfusion, heterologous or otherwise, are due to overtaxation of the right ventricle. Nevertheless, Neudörfer usually performed homologous transfusions because he noted that patients who received the usual 120 cc. of sheep blood rapidly complained of oppression, dyspnea, headache, and pain in the small of the back; their face often became ashen pale; their pulse often disappeared, and they vomited and

defecated; their urine was colored dark brownish red although free of erythrocytes.

Like Dieffenbach, Friedberg, and Kühne before him (see above), Landois indicated experimentally that transfusions of homologous blood ameliorated the effects of various poisons, such as carbon monoxide, ether, chloroform, and chloral hydrate.

Another English obstetrician followed in Blundell's footsteps and hinted at a greater advance in blood transfusion. He was John Braxton Hicks (1823-1897), who, in 1868 and 1869, attempted to counteract clotting of blood, not by defibrination but by preventing clotting by a chemical procedure. A note in the *British Medical Journal* of 8 August 1868[30] states that Hicks overcame clotting by a solution of "phosphate of soda" mixed with blood of the donor while flowing. "He had first tried it on the lower animals, and then in three cases in the human female during delivery; it had simplified the operation to a great extent. The solution is well known to be tolerated by the system." In 1869[31] he described three cases of obstetrical hemorrhage which he treated by blood made incoagulable by a "solution of phosphate of soda, sp. gr. 2.5, temp. 90°." The blood was mixed with one-fourth of its quantity of solution of phosphate of soda. The patients rallied temporarily, but all died in shock. It is certain that Hicks used inorganic phosphate quite empirically. He knew nothing about its forming complexes with calcium. The studies of William Hewson and others, about a hundred years earlier, with regard to the anticlotting effects of neutral salts, have already been discussed.

The first to connect calcium with blood clotting were Arthus and Pages (1890).[2] Nicolas Maurice Arthus (1862-1945) was professor of physiology, physiological chemistry, and microbiology at the Swiss University of Fribourg. With C. Pages he discovered that shed blood can be kept permanently liquid by the addition of a small quantity of any of the soluble salts of oxalic acid. Citrates, being relatively non-toxic, were immediately utilized by physiologists in their animal experiments which involved cannulation of blood vessels for manometric studies. In 1894 Sir Almroth E. Wright (1861-1947), a pathologist, wrote an article "on methods of increasing and diminishing the coagulability of the blood, with special reference to their therapeutic employment."[79] He dodged the issue of the therapeutic value of diminishing coagulability *in vivo*. He stated that

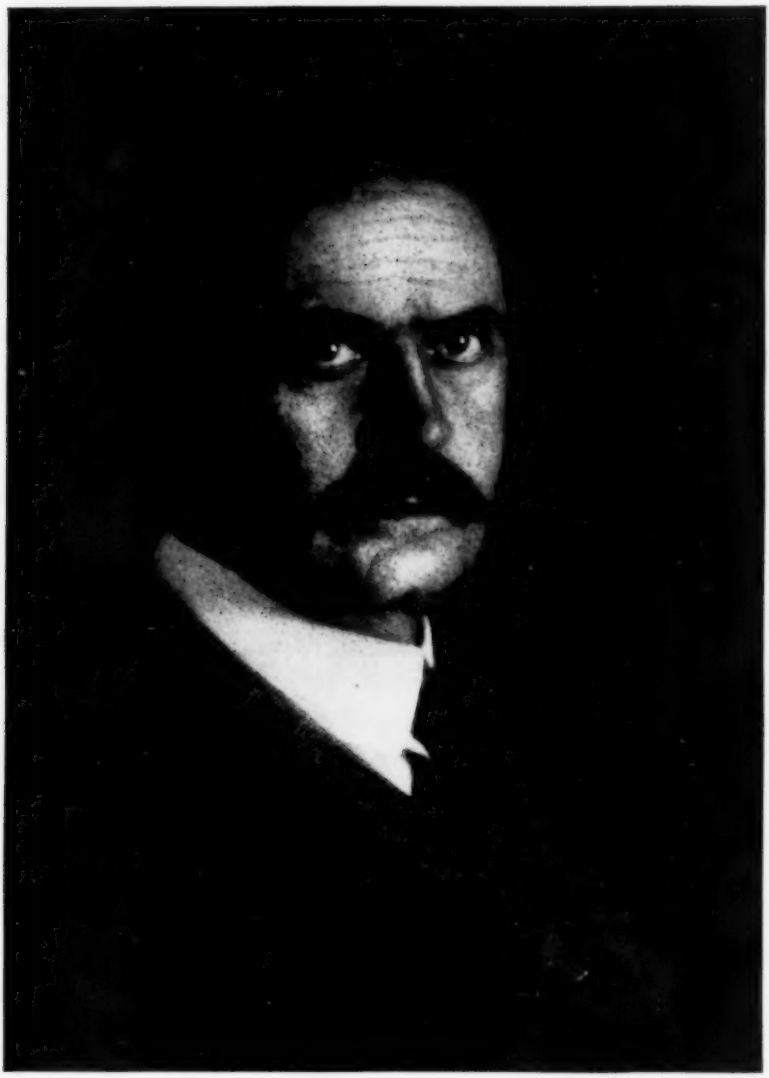

FIG. 15. Karl Landsteiner (1868-1943) at time of receipt of the Nobel Prize in Medicine in 1930.

> The physiologist is familiar with some half-dozen methods by which the coagulation of the blood may be indefinitely postponed. . . . In short, of the methods that are familiar to the physiologist, one method alone promises to be of value to the therapeutist. The method consists in operating upon the lime salts of the blood in such a manner as to render a certain portion of these salts unavailable for purposes of coagulation. Either oxalic, citric, tartaric, or malic acids, or the soluble salts of these acids are at our disposal for this purpose. Oxalic and oxalates are, however, contra-indicated owing to their poisonous properties.

He reported an increased clotting time of blood in animals into which small quantities of citrate were injected. Only rarely, however, will the clotting time of blood be appreciably increased while the concentration of calcium ions in the blood is still above the convulsive level. It is noteworthy that *discovery of the anti-clotting action of citrate on the blood preceded the use of citrate in blood transfusion by about twenty-three years.*

In 1892, a Leipzig internist, Hugh Wilhelm von Ziemssen (1829-1902) introduced *hollow metal needles* for collection of blood from the donor's veins and then its subcutaneous injection into man.[83] He stated that the blood thus injected formed no clots or thrombi *in situ* and that there resulted no febrile reaction, hemoglobinemia, or hemoglobinuria. He resorted to intravenous injection of blood through these hollow needles. His transfers were made indirectly by syringes which had to be frequently irrigated with saline to eradicate clots.

The nineteenth century closed with substantial accomplishment toward safe blood transfusion. The necessity for transfusing with whole blood rather than with serum when resuscitating from blood loss was confirmed; the dangers of heterologous transfusion were demonstrated; animal-to-man transfusion was finally abandoned; lysis of the erythrocytes of the donor in the heterologous recipient's vascular system was discovered; the spectroscope demonstrated the resultant hemoglobinemia and hemoglobinuria; renal tubular obstruction by casts of hemochromogen and generalized vascular engorgement of the renal cortex and medulla were noted; the transformation of some of the released hemoglobin into biliary pigments was recognized; the release of potassium from lysed human erythrocytes and the dangers of hyperkalemia were discovered; defibrination of blood with consequent prevention of clotting was advanced; the importance of calcium was recognized; the anticoagulant effect of calcium-binding salts was discovered, but these salts were not used clinically except empirically in a few cases.

III. ADVANCES IN THE FIRST THIRD OF THE TWENTIETH CENTURY

After Landois' work it was thought that only heterologous transfusions resulted in lysis of erythrocytes. From his own experiments, even Landois was not prepared to condemn all heterologous transfusions. Thus, between animals of the same family, as the sheep and goat, the transfusion of defibrinated sheep blood into a goat did not result in hemoglobinuria. He performed two such experiments. He also tested transfusion in dog and fox and rabbit and hare. In a dog-to-fox transfusion, and vice versa, no hemoglobinuria or cylindruria occurred. Similar results were noted in hare-to-rabbit transfusion and vice versa. He believed that transfusion within the same order, as between feline and canine genera of the Order Carnivora, resulted in lysis of erythrocytes, hemoglobinuria, and at times death.

At the beginning of the twentieth century it was first realized that homologous transfusions, especially in man, may result in lysis of erythrocytes. Even then it was thought that iso-lysins, i.e., lysins between the same species, indicated a diseased state and indeed this was used as a diagnosis of many illnesses. Thomas Wharton Jones (1808-1891) noted that red cells in blood drawn from patients with inflammatory diseases tend to form rouleaux more rapidly. Another Englishman, Samuel G. Shattock[76] (1900) studied the effects of serum from patients with inflammatory diseases upon rouleaux-formation of normal human blood:

> Having arrived thus far, I may now record my own observations, which were made with the object of seeing whether the blood serum from patients suffering with acute pneumonia, erysipelas, or rheumatism, had any result upon the rouleaux-formation of normal human blood. . . . On adding one loop of normal human blood to one loop of the pneumonic serum, an immediate result was obvious to the naked eye, the drop appearing as though it held a red precipitate in suspension. . . . The chromocytes [erythrocytes] are aggregated into long irregular rouleaux, and produce a very coarse mesh. . . . What is the result if normal human blood-serum is added (1:1) to normal human blood? In this control no appreciable difference ensues from the picture presented by normal human blood; the rouleaux maintain a moderate length and construct a uniform and comparatively close net.

There is nothing in this work that indicates even remotely a discovery of normal human blood groups containing sera with specific agglutinins. The statement of certain writers that Shattock was a co-discoverer of blood groups is thus unwarranted. He was, however, one of the first to note agglutination of human erythrocytes by serum from another individual; hitherto this phenomenon

had been noted, first by Ponfick and Landois, only in heterologous bloods. Shattock, however, ascribed this clumping of red cells to disease.

In the late nineteenth century Paul Ehrlich, Jules Bordet, Octave Gengou, and others studied the phenomenon of immunity with normal and immune bloods. Serological species specificity was discovered. Stimulated by this, Karl Landsteiner (1868-1943), while a young assistant in the Institute of Pathological Anatomy of the University of Vienna, found that the sera of certain individuals will agglutinate, or clump, erythrocytes of certain other individuals. This was later termed "iso-agglutination," meaning agglutination of cells by serum of individuals of the same species. Landsteiner's work was first reported in the *Centralblatt für Bakteriologie* for 10 February 1900, and then in the *Wiener Klinische Wochenschrift* (1901).[44] His study included 22 adults. The conclusions, translated literally, were as follows:

> If one excluded certain investigations on the blood-serum of foetal placental blood, which did not produce agglutination—Halban [celebrated Viennese gynecologist] also had found foetal blood seldom agglutinating—then the sera allow themselves in most cases to fall into three groups. In a number of cases (Group A) the serum reacts on the corpuscles of another group (B), but not, however, on those of group A, while, again, the corpuscles of A will be influenced likewise by serum B. The serum of the third group (C) agglutinates the corpuscles of A and B, while the corpuscles of C will not be influenced by the sera of A and B. The corpuscles are naturally apparently insensitive to the agglutinins which exist in the same serum.

Landsteiner's discovery of the existence of definite blood groups opened the way for safety in blood transfusion, thus making possible the support of patients with debilitating diseases or severe postpartum bleeding or during extensive surgical procedures. The discovery did for blood transfusion what Robert Koch's (1878) demonstration of the bacterial cause of wound sepsis did for surgery. For his work in immunology and the discovery of blood groups Landsteiner (Fig. 15) received the Nobel Prize in Medicine for 1930.[45]

Vienna of the early 1900's was in the vanguard of medicine. In the Second Medical Clinic of the University of Vienna, Alfred von Decastello and Adriano Sturli[16] discovered the fourth blood group, which is the rarest of the four and was missed by Landsteiner. They made other notable findings such as the inalterability of the hemo-agglutinins, i.e., serum agglutinins which agglutinate erythrocytes, by disease. They also stated that hemo-

agglutination is of no diagnostic significance in disease. By heating sera at 56° C. for 30 minutes the hemolysins were inactivated but not the hemo-agglutinins; in such circumstances erythrocytes would not hemolyse for months when kept in sealed glass tubes in sera containing their agglutinins. They thus indicated that hemolysis is dissociable from agglutination. They confirmed the work of Ascoli and Halban by finding that in neonates under six months of age specificity is often lacking; this suggested that agglutinins occur first in the serum and secondarily effect a change in the erythrocytes.

In 1907, J. Jansky[35] of Czechoslovakia reviewed preceding work on blood groups and reported a classification of his own. W. L. Moss[57] of the United States, apparently independently, came to the same conclusion but reported the four groups in a reverse sequence. Groups II and III were identical in both the Jansky and Moss classifications but groups I and IV were reversed. This lack of uniformity of nomenclature was often most disconcerting and at times dangerously misleading. The American Association of Immunologists therefore sponsored in 1927 a new classification suggested by Karl Landsteiner, who was then carrying on serological research at the Rockefeller Institute in New York; this classification has since been adopted in many foreign countries and by the United States Army and Navy.[14] The main blood groups have been classified as follows:

Original Landsteiner (1900)	Jansky (1907)	Moss (1910)	International (1927)
C	I	IV	O
A	II	II	A
B	III	III	B
—	IV	I	AB

It will be noted that what Landsteiner had called Group C in his original paper of 1900 is now known as Group O, and that he was originally not cognizant of Group AB, which consists of only 3 per cent of most populations.

Even after Landsteiner's discovery, surgeons were performing transfusion in the twentieth century without preliminary cross-agglutination tests. The " biological test" was frequently used but obviously not with full assurance. As described by Franz Oehlecker[62] (1933) of Hamburg, in the "biological test" five, ten, and twenty cc. of blood were injected at two-minute intervals. He stated that hemolytic reactions occur in the first one to two minutes

after the injection and that late reactions after a smooth transfusion are not hemolytic. The reactions were restlessness, dyspnea, back pain, vomiting, tenesmus, thready pulse, fall in blood pressure and, in extreme cases, coma. Usually recovery was rapid when not much blood was given. Thus, in Oehlecker's experience, of fifty hemolytic reactions detected by the "biological test," there was only one death and that was in a patient who had been moribund initially. Nevertheless, before the advent of cross-matching, blood transfusion under the "biological test" was performed with anxiety and uncertainty. Oehlecker pointed out furthermore that the "biological test" was useless when the recipient was in shock or under anesthesia. He infused rabbits, dogs, goats, and monkeys with human blood and found that the concentration of hemoglobin in the recipient's plasma attained its peak at one minute. In three to five minutes the plasma hemoglobin had already fallen to one half. After that the fall was asymptotic. *He thus pointed out that to exclude a hemolytic reaction the blood should be drawn early.*

No hemoglobinuria occurred when only 60 to 80 cc. of incompatible homologous blood were transfused into a man. He considered that the liver took up hemoglobin from the plasma and that the amount required to produce hemoglobinuria would depend upon hepatic function.

Cross-agglutination was first used as a test before blood transfusion as late as eleven years after the initial scientific discovery of Landsteiner. Until indirect transfusion became popularized by the use of citrate, transfusion was in the hands of surgeons. Obviously, therefore, even the leading surgeons in the early 1900's were either insufficiently trained scientifically or were too busy to keep up with the medical literature. Bernheim[5] states that at the Johns Hopkins Hospital in 1910 "not once was it even suggested that I had better wait for blood tests, and I did transfusions in every hospital in the city and many in distant communities." In 1908 Dorrance and Ginsburg[18] of Philadelphia gave a comprehensive review of blood transfusion, but did not even mention preliminary testing for compatibility. To them asepsis was of primary importance, and they used direct transfusion. Of six cases they transfused, one had an admittedly hemolytic reaction and died; another patient with pernicious anemia had an "unsuccessful" transfusion which they promised to "report later." Pepper and Nisbet[67] (1907), both instructors in medicine at the University of Pennsylvania, reported a fatal transfusion reaction. The well-developed 33-year-old male patient, who had an initial erythro-

cyte count of 1,270,000, died on the fifth post-transfusion day. It was pointed out that there was no sign of thrombosis, embolism, or infection, and that hemolysis must have been the cause of death. How much blood he received was unknown since the transfusion was by arterio-venous anastomosis after Crile's method. "Blood was allowed to transfuse from 6:33 p.m. to 7:37 p.m. Patient visibly reddened during operation. The donor grew somewhat sick at stomach, but otherwise stood the operation well." The fact that the donor did not collapse and that the erythrocytes did not rise above 1,800,000 would indicate that the patient received between 500 and 1,000 cc. of blood. Not only was no cross-agglutination test made, but there seems to have been blissful complete ignorance of the work reported in Vienna in 1900. This situation seems to have been rampant, as the authors note: "Nevertheless there was no serious doubt of the innocuousness of introducing blood from normal individuals, into other normal persons, or those suffering from hemorrhage or disease, provided the technical accidents could be obviated by some such procedure as that reported by Crile." They were referring to the method of artery-to-vein anastomosis described by the surgeon George Crile in 1907. Ignorance of a seven-year-old discovery is to be noted by their statement that "the published cases of Crile and others indicate the probable safety of the operation of transfusion in post-hemorrhagic cases, but the results in our own indicate the danger in certain pathologic conditions and the necessity of caution until we are in possession of greater knowledge." These Philadelphia physicians were probably cognizant of Shattock's work as they tested the serum of the patient's blood against erythrocytes of a normal individual with negative results. If they had been cognizant of the Viennese discovery, they would have tested his serum against the donor's erythrocytes.

In 1917, two Johns Hopkins surgeons, McClure and Dunn,[53a] reported on 150 cases of blood transfusion. They pointed an accusative but enlightening finger upon their past by noting that "eight or nine years ago, great discredit was thrown upon these laboratory tests (cross-agglutination) by most of the men doing the transfusion. It was the common saying that hemolysis or agglutination might occur *in vitro* but not *in vivo* and vice versa."

In 1911 Ottenberg,[63] of the Laboratory of Biological Chemistry at Columbia University, endorsed the use of preliminary agglutination tests before any transfusion when possible and performed apparently the first American transfusion after such a preliminary

test. He pointed out that it was most important that the donor's cells be non-agglutinable by the recipient's serum. In his Case I, the patient's blood belonged to the "2nd or 3rd agglutinative class" (i.e., Group A or B) while that of the donor, chosen in emergency, belonged to the 1st (i.e., Group O). Thus, the donor's serum agglutinated the patient's cells, but his cells were not agglutinated by the patient's serum. Sufficient blood was transfused to raise the patient's hemoglobin from 18 per cent to 42 per cent of normal. Yet the patient underwent no untoward symptoms. All the anti-A and anti-B agglutinins transfused into her with the Group O serum had disappeared. It was assumed that these agglutinins were taken up by the patient's erythrocytes in sufficiently dilute amount, however, thus not causing agglutination or hemolysis. Here was an explanation for the occurrence of *in vitro* hemolysis without *in vivo* hemolysis—a seeming contradiction which vexed earlier workers.

In the converse situation, exemplified by Case II (taken from Dr. J. G. Hopkins, 1910), the patient's serum agglutinated the donor's cells, but the donor's serum did not agglutinate the patient's cells. After the transfusion the patient became incontinent of feces and irrational. Six hours later he developed paralysis on one side and became unconscious; nine hours after the transfusion he died. It appeared that death was caused by intravascular agglutination. In 1913, Ottenberg and Kaliski[64] showed that transfusion accidents can be prevented by careful preliminary agglutination tests. They also advocated testing the donor for syphilis by Wassermann reaction. Ottenberg and Epstein[64] (1908) were the first to point out that iso-agglutinins are inherited according to Mendelian rules. Thus, although a child is more likely to be of the same group as his parents than any other group, he is by no means necessarily so. The trend of the early twentieth century of using "blood relatives," even at the Johns Hopkins Hospital, thus was not vindicated.

Scientific knowledge ran far ahead of practical application not only with the use of cross-agglutination tests prior to transfusion, but also with the use of citrate as an anticoagulant. Although the rationale of this use was discovered in the early 1890's (see above), it was not put to actual use until shortly before World War I. Since the 1890's laboratory physiologists had been using citrate as an anticoagulant for their animal experiments. "Hirudin," a crude extract from the cervical glands of the leech, first tried by Landois[43] (1875), was toxic and it has not been considered practi-

cal to persist in attempts to obtain a non-toxic preparation of it. A buffered sodium phosphate solution as an anticoagulant is contraindicated for two main reasons: (i) Phosphate ions form a colloidal complex with calcium which tends to disappear from the blood stream by being phagocytosed by macrophages of the liver and spleen (McLean and Hinrichs,[54] and Gersh,[22]); (ii) Phosphate ions are not oxidised by the body, but citrate ions are rapidly

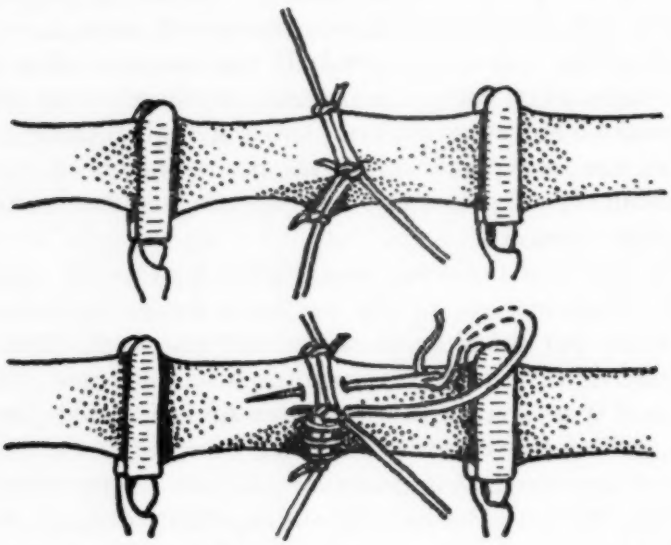

FIG. 16. Alexis Carrel's technique (1902) of vascular anastomosis with the use of three guide sutures arranged triangularly.

oxidised to water and carbon dioxide. During the temporary renal shut-down, which invariably occurs in shock, the only avenue of escape of phosphate ions out of the body is interrupted. Blood transfusion is, *par excellence,* the treatment of hemorrhagic shock, and it would not do to load thereby the vascular channels with phosphate ions. The oxalates are, for similar reasons, too toxic.

Before physicians made use of a satisfactory anticoagulant they had an exciting time with transfusion. At the opening of the twentieth century Carrel[11a] introduced his technique of vascular anatomosis by the use of guide sutures and intima-to-intima apposition (Fig. 16). It had been known since the experiments of John Hunter and of his student William Hewson that the clotting even of stagnant blood is greatly delayed when the blood is in contact exclusively with the vascular intima. Hewson (1774) wrote:

> Having laid bare the jugular vein of a living dog, I made a ligature upon it in two places, so that the blood was at rest between the ligatures; then covering the vein with skin to prevent its cooling, I left it in this situation. From several experiments made in this way, I found in general, that after being at rest for ten minutes, the blood contained fluid; nay, that after being at rest for three hours and a quarter, about two thirds of it were still fluid, though it coagulated afterwards. Now the blood, when taken from the vein of the same animal, was completely jellied in about seven minutes.

Carrel's technique was adopted by several surgeons for direct transfusion. It required considerable skill, hence simple modifications of the principle were introduced by Payr[66] (1900) and

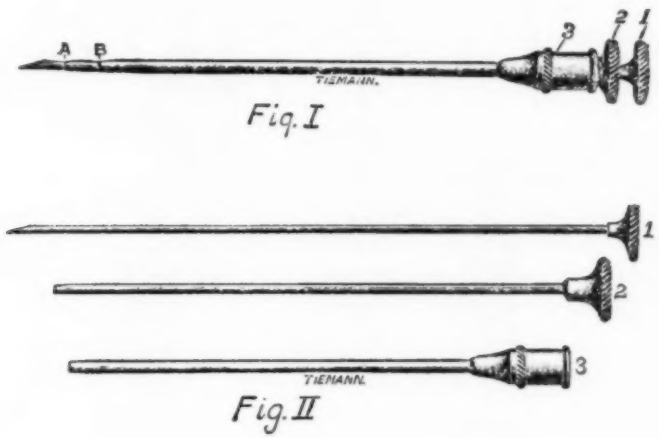

FIG. 17. The Lindeman-needle or cannula: Fig. I. The three parts connected; Fig. II. The three parts separate. (After Lindeman, 1913)

Crile[13] (1907), who everted the mobilized donor's artery over a metal sleeve. The recipient's vein was then tied over the everted artery, intima-to-intima. No preliminary cross-agglutination tests were performed; a donor's artery was sacrificed; and the exact quantity of blood transfused was no more certain than during the day of Lower. Bernheim simply used silver connecting tubes, as had been suggested by Andreas Libavius three hundred years before. "Nothing was more depressing and discouraging than to see an individual die with a donor ready and willing to give all the blood required simply because a clot or other misadventure prevented the flow."[5] After Germany went to war, in World War I, Sauerbruch[73] (1915) dispensed with sutures and metal sleeves. The distal end of the radial artery of the donor was divided and the proximal end of the artery was introduced into a slit in the

median vein of the recipient. He claims to have used this method in field hospitals. The disadvantages of using juxtaposed vessels of donor and recipient prevented the method from becoming practical or popular.

In 1913, Lindeman,[50] an internist at the Bellevue Hospital in New York, introduced his "Lindeman needle" (Fig. 17). It consists of a cannula-obturator system. After withdrawing the needle-

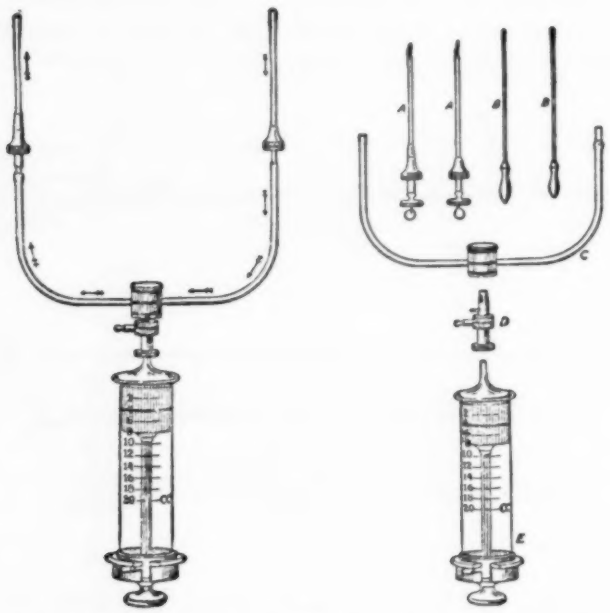

FIG. 18. Bernheim's vein-to-vein transfusion device using a 20 cc. record syringe and a two-way turn-clock. The veins of donor and recipient were thus connected by a hollow-metal U-tube, (c). (After Bernheim, 1915)

like obturator and fine internal cannula, the external blunt cannula is left in the vein for the transfusion. Lindeman used one of his needles in the donor and another in the recipient (see also Fig. 18 from Bernheim[4]). In 1914 he reported on 135 transfusions by the syringe-cannula system.[51] The Wassermann test, cross-matching, and the "biological test" were performed prior to all transfusions. The largest amount of blood drawn from a donor at one sitting was 1400 cc. from a male patient weighing 79 kg.; 900 cc. to 1000 cc. were frequently drawn at one sitting! The recipient incidentally came to autopsy; the puncture sites in the veins were invisible and had healed by first intention. Blood transfusion, which hitherto had been done mainly by surgeons partly because

of the necessity of cutting down on veins, now entered the domain of the internist. Since the liver factor in pernicious anemia had not yet been discovered, extensive transfusion was used for the maintenance of patients with this disease.

At that time, in the United States, there were other variations of indirect and direct transfusion. One of the most primitive was the indirect method of Kimpton and Brown[39] (1913) of Boston, in which blood was collected into a wax-lined tube with a terminal cannula which was to fit into the recipient's vein (Fig. 19). Difficulties with clotting and the method's unwieldiness soon led to its abandonment. At the Johns Hopkins Hospital, Moss[58] (1914) was transfusing with defibrinated blood by gravity (Figs. 20 and 21). He noted that defibrination did not result in hemoglobinuria except when incompatible blood had been used. Unger[77] (1915) of New York prevented the accumulation of clots in a direct transfusion system by introducing a stopcock which alternately connected a syringe for blood to the donor and, at the same time, a syringe with saline to the recipient. By turning the cock, the syringe with blood was immediately connected to the recipient and the syringe with saline to the donor (Fig. 22). One of the simplest, most effective, and ingenious instruments for direct transfusion was developed by the distinguished surgeon, Michael E. DeBakey[15] (1935), then of New Orleans, now of Houston. Blood was milked from donor to recipient by a hand-manipulated wheel (Figs. 23 and 24). The circuit was only 18 inches; there was no dead space; there could be no injury to erythrocytes by valve or syringe; and the blood remained out of the body only a short time, thus reducing the chances of clotting. Cleansing the instrument merely meant cleaning the tube and needles.

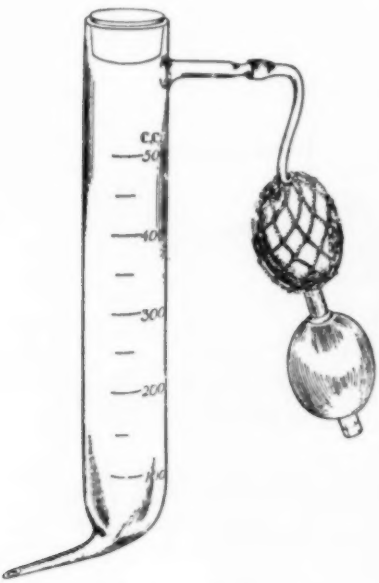

FIG. 19. The Kimpton-Brown tube, lined internally with a thin, even layer of solidified wax. (After Kimpton and Brown, 1913)

One of the major advances in blood transfusion was to appear almost simultaneously with the onset of World War I. In April

1914, A. Hustin[34] of Belgium reported the use of sodium citrate and glucose in the prevention of coagulation of blood intended for transfusion. He first used these agents in March 1914. Hustin mixed blood with an equal volume of citrate and dextrose solution. Physiologists had been using citrate as an anticoagulant in their experiments for almost a quarter of a century. Was the laboratory

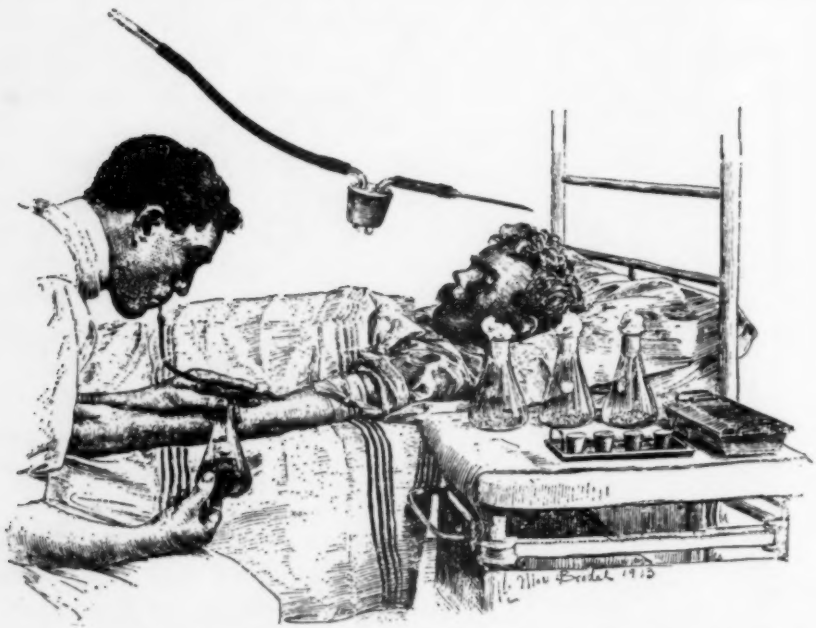

FIG. 20. Collecting blood from a donor for defibrination, by shaking with glass beads, at the Johns Hopkins Hospital in 1913. Note the empty Erlenmyer flasks containing glass beads. (After W. L. Moss, 1914)

man so utterly divorced from the outside world or was the clinician so completely unaware of laboratory advances? At that time the laboratory man (physiologist and pharmacologist) realized that it was not possible to render circulating blood incoagulable by the injection of sodium citrate because of the action of ensuing hypocalcemia on the heart and neuromuscular system; he thus could perfuse only whole organs with blood made incoagulable by citrate and he frequently had recourse to defibrinated blood. Hustin showed that a certain amount of citrate can be introduced into the circulation of man innocuously. A liter or more of blood was made incoagulable *in vitro* by a small quantity of citrate; this did not produce hypocalcemia in the recipient. Braxton Hicks had already used phosphate in blood as an anticoagulant for indirect trans-

fusion in four cases in the nineteenth century[31] but three of his four cases died of hemorrhagic shock, after rallying briefly, and not in hypocalcemic tetany. A New York surgeon, Richard Lewisohn[46] (1915), and an Argentinian, L. Agote[1] (1915) of Buenos Aires, independently published results of indirect transfusion in

FIG. 21. Transfusion of defibrinated blood at the Johns Hopkins Hospital in 1913. The rubber tube forms a few coils in a basin containing warm water. (After W. L. Moss, 1914)

which sodium citrate in a relatively small volume of water was added to blood as an anticoagulant. Bernheim[5] remarked that citrate made transfusion available throughout the world in all ranks and "nothing but knocked into a cocked hat great transfusion specialists like me and others who could be mentioned."

Lewisohn and his co-workers[47] (1916) found that an 0.1 per cent concentration of sodium citrate in blood *in vitro* does not delay clotting but that a 0.15 per cent concentration will allow fluidity for at least two days. They therefore advocated a 0.2 per cent concentration of citrate in blood, or 2 Gm. per liter. They found that as much as 2500 cc. of blood with a sodium citrate concentration of 0.2 per cent could be introduced into an adult without toxic effects; this implies 5 Gm. of sodium citrate.

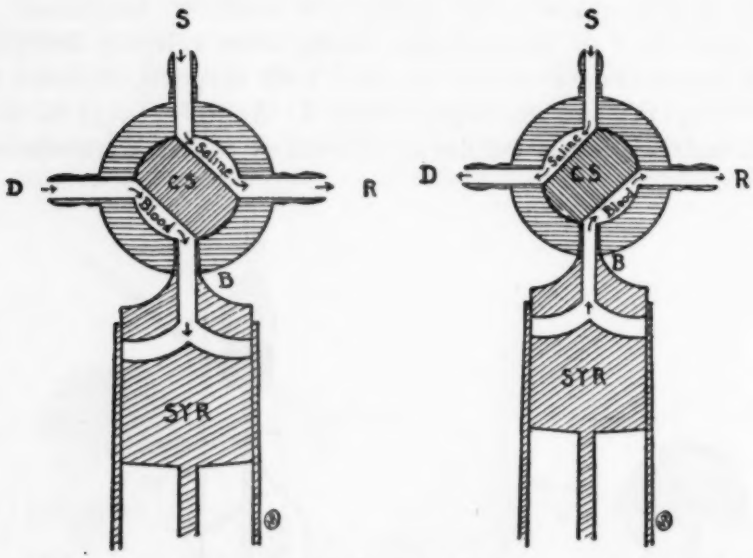

FIG. 22. Unger's cock with four outlets. Outlet *B* is connected to the blood syringe, *S* to the saline syringe, *D* to the donor's vein, and *R* to the recipient's vein. At the left blood is being drawn from the donor, while the recipient receives a little saline; at the right it is being injected into the recipient while the donor receives a little saline. (After Unger, 1915)

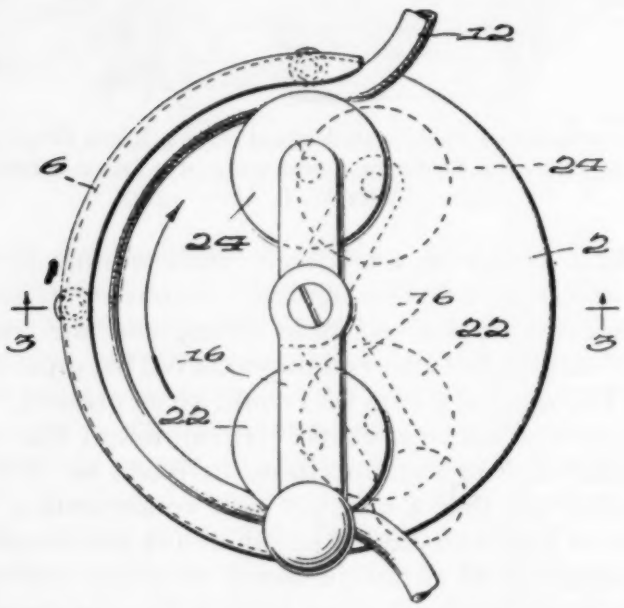

FIG. 23. DeBakey's simple continuous-flow transfusion pump. The blood is milked along the rubber tube by a hand-manipulated rotating wheel. (After DeBakey, 1935)

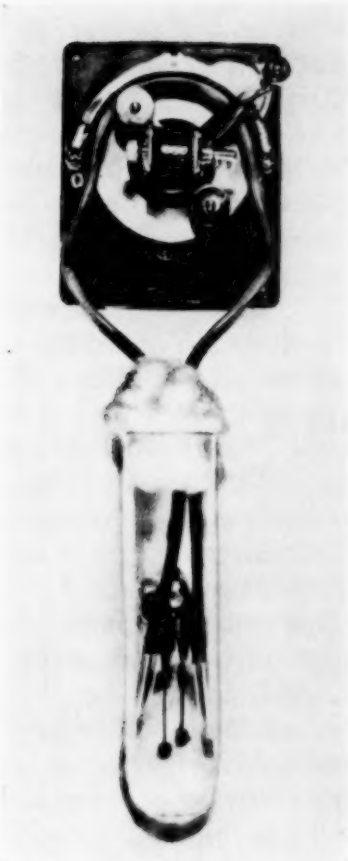

FIG. 24. DeBakey's continuous-flow transfusion pump ready for use. (After Kilduffe and DeBakey, 1942; courtesy of the C. V. Mosby Co.)

During World War I, Salant and Wise[72] (1916), of the Bureau of Chemistry, United States Department of Agriculture, studied the toxicity and decomposition of sodium citrate in animals. The toxicity, as indicated by tremors and convulsions, depended upon the rate of injection, the fatal dose varying between 0.4 and 1.6 Gm. per kg., intravenously. They found that large amounts of citrate given orally produce an alkaline urine and that the bicarbonate output in the urine rises. The citrate radical is rapidly oxidized to water and carbon dioxide by the tissues, as Batelli and Stern[3] had shown in 1911. In 1917, the Allied Armies began the use of citrated blood, which was introduced by a Canadian army medical officer, Oswald H. Robertson.

The advent of citrated blood popularized indirect transfusion, and the percentage of non-hemolytic reactions with chills and fever increased. Accusative fingers pointed to the possible toxicity of citrate. But Lewisohn and Rosenthal[48] contended that chills may follow even an intravenous infusion of plain dextrose. When the transfusion sets were cleaned and sterilized on the wards by the student nurses there was a 20 per cent incidence of chills and fever. When the apparatus and solutions were prepared by competent technicians in a central preparation room and triple-distilled water used to dissolve the citrate, the incidence of chills and fever fell to 1 per cent.

A distinct advance which followed the introduction of citrate as an anticoagulant was the storage of blood in a cold "bank." Defibrinated blood does not store or survive well. In 1918 Robertson stored blood for as long as 21 days and used it to treat hemorrhagic shock on the battlefield with gratifying results. His discovery of the advantage of adding glucose to blood was exhumed in the beginning of World War II by British scientists who also noted that an acid reaction is favorable for the survival of erythrocytes and prevents carmelization of the dextrose during autoclaving. Robertson's achievement lay in obscurity for twenty years until the Spanish Civil War (1937-39) when blood was first stored in large refrigerators with a minimum of shaking. Before the outbreak of World War II, Bagdassarov (1937) and others in the U.S.S.R. developed their blood transfusion service along the lines of the Spanish. At the time, the Soviets also conceived and exploited the use of cadaver blood.

Shamov[75] (1937) writes that when he introduced blood transfusion into the Soviet Union in 1919, relatives often refused to give their blood to save the life of a dear one, due to the fear of giving

so valuable a part of them. "Cadaver blood in the imagination of a simple and narrow-minded person is involuntarily connected with 'ptomaines,' corruption, a multitude of microbes. . . ." Shamov pointed out that by autopsy, on the other hand, a body can be exonerated from suspicion of disease with much greater certainty than a live donor.

As chief surgeon to the Surgical Clinic of the Skifosovsky Institute, Central Emergency Hospital, Moscow, S. S. Yudin[80] performed the first human transfusion with cadaver blood on 23 March 1930 on a young man in severe shock who severed blood vessels at the elbow in attempted suicide. The experiment was thus considered justifiable. The patient was transfused with blood from a 60-year-old man who died six hours previously from head injury. The abdomen of the corpse was painted with iodine and 420 cc. of blood were drawn from the inferior vena cava. The recipient improved promptly and recovered.

M. C. Skundina, S. I. Barenboim, and S. S. Yudin (1932-1935) studied the oxygen consumption of dogs before bleeding, after partial exsanguination, and after transfusing them with fresh canine blood. The transfusions resulted in prompt revival with augmentation of oxygen uptake and rise in the oxygen concentration of their venous blood. Similar results were obtained in human beings. They found that intestinal bacteria enter the portal vein after twenty hours in the cadaver kept at room temperature. They thus put the limit of usability of a cadaver at six hours after death in summer and eight in winter. Blood was collected from the internal jugular vein through a glass cannula with the body in the head-down position. They did not use cadavers of persons dead from injury which might result in infection of the blood-stream. As much as two to three and one-half liters could be obtained from a single cadaver. The collected blood usually rapidly coagulated but in one-half to one and one-half hours it became liquid again and would not coagulate, presumably due to fibrinolysis. Such blood could be preserved without anticoagulant and was said to undergo hemolysis *in vitro* after a longer interval than citrate-preserved blood. In the 927 transfusions up to 1937 there were no "toxic manifestations." The seven fatalities were caused by technical error and not from cadaver blood as such. A preliminary autopsy and Wassermann test were prerequisites.[81,82]

Transfusion with placental blood has not proven practicable. Thus Howkins and Brewer[32] (1939) of London and Cambridge found the average placenta to yield 47 cc. of blood and that

contamination was present in about one-fourth of the collections. Naegeli (1940) [60] has reviewed this subject.

Summary

The first scientific experiments on transfusion were done in the seventeenth century by members of the newly formed "Invisible College" of England: Wren, Clarke, the Coxes, Hooke, Boyle, Wilkins, and especially Lower. Exsanguinated dogs were revived by direct and indirect homologous transfusion; exchange-transfusion was successfully performed; medicaments were shown to be effective when administered intravenously. These advances followed the publication of Harvey's research on the circulation by almost a generation.

The heterologous animal-to-man transfusions performed and advocated by Denis in France were dangerous and unscientific. The amount of blood directly infused, thanks to clotting, was probably much less than postulated. Ignorance of antisepsis, asepsis, and immunology would have resulted in many disasters had blood not clotted readily and had transfusions been frequent. It was thus fortunate that transfusion took a nap for over one and a half centuries.

The eighteenth century was by no means a sterile mule for transfusion. Priestley and Lavoisier discovered oxygen, and Lavoisier and Laplace described respiration as an oxidation of carbon. Rosa noted that an animal in severe shock may be resuscitated by whole blood but not by serum.

Advances of the nineteenth century began with the important cross-circulation experiments of Bichat which indicated definitely that oxygen is transported by the blood. Demonstration of this by more direct means, however, had to await development of blood-gas analysis. Transfusion was re-introduced in England on a tiny scale by Blundell who performed many canine experiments and adhered closely to the use of homologous blood in closely selected moribund cases. He demonstrated the potential lethality of heterologous transfusion. Prévost and Dumas discovered that blood can be made incoagulable by defibrination. Bischoff demonstrated the efficacy of defibrinated blood in relieving hemorrhagic shock and his protocols show that heterologous defibrinated blood may be as lethal as the non-defibrinated blood. Panum successfully performed a practically complete exchange transfusion in a dog with defibrinated homologous blood. Various German investigators suggested exchange homologous transfusion for elimination

of various toxins, such as carbon monoxide. Ponfick delivered the *coup de grâce* to heterologous transfusion and was the first to note that the bloody urine was not a hematuria but a hemoglobinuria. He found that the source of the hemoglobin was the donor's erythrocytes and not those of the recipient. Oliguria with casts in the tubules was recognized. Landois suggested that hyperkalemia may be the lethal factor in some heterologous transfusions. Arthus and Pages connected calcium with clotting. It is noteworthy that discovery of the anticlotting action of citrate on blood preceded the use of citrate in blood transfusion by over twenty years, even though physiologists had been using citrate as an anticoagulant in their experiments.

The twentieth century was ushered in by Landsteiner's discovery of blood groups which opened the first safe highway to transfusion. This was made possible by immunological research performed by Ehrlich, Bordet, Gengou, and others. In the United States, however, transfusions were being performed without cross-matching, even in such prominent medical centers as Baltimore and Philadelphia, as late as a decade after the Vienna discovery and with apparent ignorance of the latter.

Citrate was introduced as an anticoagulant for blood transfusion by Hustin, Lewisohn, and Agote—but the time was overly ripe! Citrate made direct transfusion almost obsolete and opened the way for the institution of cold "blood-banks" in the Spanish Civil War. Blood, as the perfect substitute for hemorrhagic shock, was thus given legitimate preference over plasma. Soviet surgeons meanwhile demonstrated the feasibility of using the blood of recently deceased persons.

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Notes and Queries

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Benjamin Waterhouse's Manuscript Notes on the Lectures of John Hunter, 1777-78

Catalogued as an anonym, a 319-page quarto volume of manuscript notes on the lectures of John Hunter, 1777-1778, that had been in the library of the College of Physicians of Philadelphia for fifty years[1] was recently discovered to be the work of Harvard's first professor of medicine, the "American Jenner," Benjamin Waterhouse. As it establishes, apparently for the first time, the fact that Waterhouse was one of Hunter's American pupils and reveals the early presence of certain traits of character that were later to do this prominent American physician active disservice, a few words on the manuscript may be in order.

The first substantial clue to the identity of the author of the manuscript was provided by the initials "B. W." appended, p. 212, to a footnote. The denouement was not long delayed thereafter, for on p. 223 there begins the following footnote:

Memorandum

A Question here arises which J. Hunter gives me the credit of first suggesting viz., Are Women as subject to the Lock-Jaw as men? If it is found they are not what is the reason seeing their habits are more irritable and their minds (with due submission) weaker than Males—for J. Hunter has asserted that the Lock-Jaw happens more frequent in weak & superstitious minds than otherwise. It must be understood that we mean the *Spontaneous Lock-Jaw* and not that from accidents. Query—Is not the Lock-Jaw nearer a kin to the Hydraphobia than any other disease? In both there appears to be a dread of Water & a very high degree of irritability—observe also that cold bathing has been recommended for both.

It appears and J. Hunter himself thinks that no Medicine comes so near a Specific in the Lock-Jaw as the Sach. saturni—and hopes that in some cases it may turn the Scale in favour of Life—(see the case where the Lead was administered & the Patient evidently the better for it)

February 8th 1778 B. Waterhouse

According to Peachey,[2] Hunter's 1777-1778 course was to begin on October 27, 1777, and to extend through the winter with lectures being delivered on Mondays, Wednesdays, and Fridays.

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[1] The volume (10a 165) was accessioned in 1904, as the gift of the Rev. William Ashmead Schaeffer. On the title-page is the signature "Wm. Ashmead M.D. Phila." Ashmead was a Fellow of the College whose dates (1801-1888) precluded his being considered as author of the notes.

[2] Peachey, G. C. *A memoir of William & John Hunter.* Plymouth, Brendon, 1924. P. 163.

The title-page of the Waterhouse manuscript reads: "Physiological Lectures by John Hunter, F. R. S. &c. &c. &c.[3] London, October 28th, 1777." The notes on the first lecture repeat the date of the title-page. Precise dates are given for 45 lectures, 5 more are less explicitly marked out, and there are textual and other indications that there was telescoping of some further lectures. On page 319, we read: "April 1st 1778 and last. Upon Corns &c (See Red Book C)."[4] Though Waterhouse's dates may be suspect in some instances, it is clear that he was an assiduous pupil, attending a very large number of the 60-odd lectures that seem to have comprised Hunter's course.

Under the brief note on the lecture of April 1, p. 319, is another note, in which reference is made to "Dr Saunders on the Red-Bark, p. 41." As William Saunders' "Observations on the superior efficacy of the red Peruvian Bark" was first published in 1782, this note was obviously added at a later date. The same is almost certainly true of two pages of memoranda from the successive lectures which conclude the book, following the intervening remains of several leaves that have been cut out of the volume.

Waterhouse's notes are quasi-verbatim reporting, consistently following the lecturer's use of the first person singular, and taking scrupulous care to indicate the authorship of even the footnotes.[5] They were also clearly a working-up of stenographic or abbreviated notes taken during the lectures. They are not so extensive as Rumsey's of a decade or so later,[6] are comparable in many respects with those of Parkinson,[7] also taken nearly a decade later. Both Waterhouse and Parkinson, doubtless like many another of Hunter's pupils, apparently felt able, as a result of practical experience and wide reading, to use a measure of discrimination in compiling their records of the lectures. This is indeed none too gently suggested in Waterhouse's record of Hunter's introductory lecture, which reads as follows:

Octob. 28th 1777

Lecture 1st

This lecture contained besides laying before us his design his Idea of Matter, which was nothing different from what we find in late Authors on

[3] The *&c's* may possibly be an impish allusion to the fact that at this time Hunter was advertising himself as "F. R. S., Surgeon Extra-ordinary to the King, Surgeon to the Army and to St. George's Hospital." Peachey (p. 167) says that after 1777 Hunter omitted references to his titles and honors.

[4] On the preceding page (p. 318), under the same date, "April 1st 1778," we read: "Here follows the Lectures upon the Teeth but as JH has just Published a Practical Treatise on them I thought it needless to take them down—N.B. John Hunter published a Treatise on the Teeth in 1774 [B.W. was in error: the date was 1771] but the Practical one printed so as to add to the former was Published March 1778."

[5] In addition to Waterhouse's own initials or signature, as referred to above, the initials "JH" appear a number of times. The initials "JF" appear at least once in the body of the text. The memoranda make it clear that they refer to Dr. John Fothergill.

[6] In: *The works of John Hunter.* Edited by James F. Palmer. Vol. 1. London, Longman, 1837.

[7] *Hunterian reminiscences; being the substance of a course of lectures on the principles and practice of surgery, delivered by . . . John Hunter, in the year 1785; taken in short-hand . . . by . . . James Parkinson . . . edited by . . . J. W. K. Parkinson.* London, Sherwood, Gilbert, and Piper, 1833.

that subject, and is recapitulated in the Second Lecture. Mechanical Mixture, and Chymical Attraction were explained, but did not differ from Dr Fordyce & others. He avoided giving anything like the History of his Subject which he said would be only a history of himself.

Lecture 2d

That Waterhouse had a just regard for his guineas and his opportunities this manuscript taken alone bears witness. But there is more to it than this. Other references in the text to the "Red Book C" cited above make it clear that it contained notes on the cases Hunter used by way of illustration. Further, the memoranda at the back of the book remind of "Some particulars concerning the Gonnorh. in the book mark'd (B)." The curators of these companioning volumes, B and C, may be interested, if the volumes be extant and identified, to put them also on the record, thus making known what might, in its totality, be the most complete and provocative account of Hunter's lectures in the first decade of his teaching career. The young *Liberae Reipublicae Americanae Foederatae Civis* himself, who opens what we may call Book A with the notes quoted above, and closes it with a later reflection, "The Lecture on *Poisons* is very defective," was a pupil ill-disposed, one gathers, to nurture any tendency on the part of his lecturers to self-complacency; but he is of course not necessarily a young man of negligible quality on that account.

W. B. McDANIEL, 2D

E. Darwin on Robinson

Erasmus Darwin (1731-1892), father of the short-lived genius, Charles, and grandfather of the immortal one, was not a man to suffer fools gladly. An end-paper and fly-leaf of *An essay on the gout* (second ed. [1756]) by Nicholas Robinson now in the Osler Library carry the following castigations under E. Darwin's signature and in his handwriting:

Insufferable Nonsense throughout! I look upon the Author of this Book to be a very silly Fellow. The Language abounds with Tautologys, is indelicate, & uncorrect. The Reasoning is weak, & generally unimportant, common, or false, and a surprising Ignorance is shew'd in the most common Theory of Physic. One Instance of Tautology vid. p. 111, of false Theory, p. 137, 149, indelicate Expression, 155. He promises somewhere to give a Chapter on the Sciatica at the end of his Work, which however lucky for his unhappy Reader He has not perform'd. The only Pages that contain anything of Practise are p. 100, 136, 141, 25, 75, 145 &c.

> Your Doctors of old were extravagant folks,
> While they gave you Counsel, their Fools gave you Jokes;
> Our Author, so frugal, neglects this old Rule,
> And exhibits himself both as Doctor & Fool.

I have corrected the critic's second line which reads "your Consel." The "indelicate" passage is disappointing: he considers "a well-fatted Buck, to be now and then as proper Aliment for the gouty Person *as he can fasten*

his Teeth upon" (the italics being Darwin's underlining). The old zoologist's armorial book-plate, looking like an advertisement for British petrol, is pasted in in its "Lichfield 1771" form with motto, *E conchis omnia,* while its later form with un-shelled motto, *Cave et aude,* has been tipped in by the donor, the late J. C. Simpson, B.Sc., LL.D., professor of histology at McGill and unforgettable dean of the faculty from which, as he comically put it, he had "failed to graduate." While working at Cambridge he earned the friendship of Sir George H. Darwin, who presented him with these and other family relics.

That the epigram was composed as well as written by Erasmus Darwin and apparently had never been published, at least up to 1948, was kindly confirmed for me by an authority, Miss E. Blackwell, who wrote me that it is among other unprinted humorous verses of his copied by Sir Francis Darwin into a commonplace-book now at Down House. Our book is there noted as its source.

The only work by Robinson in Osler's original collection is *A new system of the spleen,* 1729. In it he has recorded a similar judgment but more politely; "R. wrote six or seven works, none of them of any importance." Both Osler and Moore in the *Dictionary of National Biography* give him too much credit for a report of Marlborough's last illness: it amounts to no more, on p. 83, than a rumour that the "intrepid Son of Mars" in his last moments wept like a child "through a Decay of the nervous System."

W. W. Francis

Some Occupants of 52 Rue d'Auteuil, Paris
Franklin — Rumford — Bonaparte

Paris boasts many interesting links with the past in the form of both pretentious and unpretentious homes in which celebrated figures have lived. Many such homes today house equally worthy if less famous people; in the case of the more pretentious dwellings we often find that they have been converted to some form of communal use. Thus Lavoisier's country seat at Fréchines[1] is now in use as a retreat operated by a religious order for aged persons; today the house at N° 52 Rue d'Auteuil (Paris) is in use as a school. In both cases the houses appear externally much as they must have done in the eighteenth century when they were built. Let us now consider our reasons for thinking of the house in the Rue d'Auteuil at the same time as Lavoisier's country seat.

In the middle of the eighteenth century the Jews in France received their economic and to some extent their social emancipation. They also began to adopt patronymics, and at the period in question Egyptian names were in vogue. A successful Jewish banker who had chosen the name of Monsieur Osiris decided to build a house for himself which would be

[1] Denis Duveen, Paper presented before the 122d Meeting of the American Chemical Society at Atlantic City, September, 1952.

consonant with his affluent position in the community. With this object in view he bought approximately three acres of land in Auteuil[2] on which he had the house erected which is still standing and known as N° 52 Rue d'Auteuil. He also engaged a gardener and had the grounds attractively landscaped. Then, wishing to have a tombstone of sufficiently distinguished character, he had a full-size copy made of Michelangelo's famous statue of Moses. This statue he rather morbidly had placed in his garden until such time as it should be needed for his grave. Upon his demise it was found by his executors that the weight and size of the statue rendered its transport from the house in Auteuil to the cemetery of Père Lachaise (Montmartre) extremely difficult. A simple solution was devised and put into effect—a sculptor was commissioned and ordered to carve a second copy of Michelangelo's masterpiece on the spot in the cemetery, and the original copy was left in the garden of N° 52 Rue d'Auteuil.

The next occupant of N° 52 Rue d'Auteuil was a wealthy and vivacious widow, Madame Helvétius,[3] with her two daughters. Madame Helvétius came from a poor family of ancient lineage, the Lignevilles, in Lorraine. Her youth was spent in Paris in the home of an aunt, a writer of some repute named Madame de Graffigny, where she was assiduously courted by a young and impecunious student of good family. Madame de Graffigny frowned on the idea of marriage between the two and, although the young couple bowed to her wishes, they swore, and maintained, perpetual friendship. This student's name was Turgot who was later, when comptroller-general of finance, to become well acquainted with Lavoisier and Franklin and to remain a devoted friend and admirer of Madame Helvétius in marriage and widowhood. Her husband had been the son of a well-known financier, doctor, and member of the prosperous but unpopular *ferme générale,* of which Lavoisier was such an outstanding administrator. After Helvétius' death, his widow gave regular receptions which were attended by such distinguished guests as Voltaire, Fontenelle, Turgot, and Franklin.

The widow Helvétius was definitely a character in her own right and lived, as Fay says,[4] "in rustic magnificence, surrounded by her eighteen cats, ten dogs, various birds, philosophers and Masons." It should be mentioned that Franklin was a past member of the Nine Sisters' Lodge of Freemasons which had been founded largely through the influence of her late husband, and the entire Lodge is said to have met on numerous occasions at her house.

At this time the widower Franklin, who was living in Passy,[5] became a constant visitor at the house of Madame Helvétius in Auteuil and finally

[2] Egon Larsen, *An American in Europe,* London, 1953, p. 157. Auteuil, now part of metropolitan Paris, was at that time a pleasant rustic suburb.

[3] Most of the information quoted regarding Madame Helvétius, has been obtained from two sources: (a) Carl Van Doren, *Benjamin Franklin,* New York, 1938, pp. 648-653; (b) Bernard Fay, *Franklin, the apostle of modern times,* Boston, 1929, pp. 459-462.

[4] *Loc. cit.*

[5] During this period Passy, which is adjacent to Auteuil, was also a village suburb of Paris although today it forms part of the metropolitan area.

fell completely in love with the lady, proposing marriage unsuccessfully to her in 1780. His *affaire* with Madame Helvétius resulted in the composition of two charming and most entertaining letters,[6] probably written late in 1778, which are not widely known and are, therefore, reproduced here *in extenso*:

The Flies to Mme. Helvétius

The flies in Franklin's House ask Permission to present their Respects to Madame Helvétius, and to express in their best Language their Gratitude for the Protection which she has so kindly given them,

Bizz izzz z wizz a wizz zz izzzzzzzz, &c.

We have lived for some time under the hospitable Roof of this good Man Franklin. He has given us free Lodging; we have moreover eaten and drunk the whole Year long at his Expense without costing us anything. Often when his Friends and he finished a Bowl of Punch, he left a sufficient Quantity to intoxicate a hundred of us other Flies. We drank freely of it, and afterwards made our Sallies, our Circles and our Cotillions very prettily in the Air of his Room, and gaily consummated our little Loves on his Nose. In short we should have been the happiest People in the World, if he had not permitted to remain at the top of his Wainscoting a Number of our sworn Enemies, who there hung their Webs to take us, and dismembered us without Pity. Savage, crafty and ferocious Things, an abominable Mastication! You, most excellent Lady, had the Goodness to order that all these Assassins with their Dwellings and Traps be swept out; and your Orders (as they must always be) were executed on the Spot. Since then we have lived happily, and enjoy the Bounty of this good Man Franklin without Fear.

There remains but one Thing to be desired to assure the Permanence of our Happiness; permit us to say it,

Bizz izzzz wizz a wizzzz izzzzzzzz, &c.

It is to see you have henceforth but one Household.*

Franklin's Dream

Last Night I retir'd to my Chamber much shaken at the cruel Resolve, which you had just unequivocally declar'd that you would continue single the Remainder of your Life, out of Respect for the memory of your Husband. I threw myself on my couch; & dreaming I had died, found myself transported to the Elysian Fields. I was asked, if there was Anyone in particular that I wish'd to see?—Take me where there are Philosophers!—Two make their homes here in this garden; they are Neighbors & the best of Friends.—And who may they be?—Socrates and Helvetius.—It is with the highest Esteem that I regard them both; but let me see Helvetius first, for I understand a little French, but not a Word of Greek.

He receiv'd me most courteously, my Name & Reputation having, he said, been long familiar to him. He ask'd a thousand Questions about the War, and the present State of Religion, Liberty, & the Government of

[6] The text of the two letters is taken from *Dr. Benj. Franklin and the ladies: Being various letters, essays, bagatelles, & satires to & about the fair sex*, Mount Vernon, 1939, pp. 40 and 41-42 respectively.

* This is in the translation made by Paul McPharlin for his edition of Franklin's *Satires & Bagatelles;* Detroit, 1937.

France.—But you do not ask after your cherish'd Madame Helvetius; for her Part, she still loves you most devotedly;—it was in fact, no more than an Hour ago that I was in her Company.—Ah, he sigh'd, these are Memories of a happy time long past, that you bring back to me. But to achieve Happiness here, one must forget the Past. The first few Years, I thought of no one but her. But presently I found Consolation. I took another Wife, as like the first as it was possible to find. She is not, it is true, quite so beautiful; but she has as great a Fund of good Sense; she is more vivacious,—and besides, she loves me infinitely. Her continual Study is to please me: just now, she actually is out gathering with her own hand the choicest Nectar & Ambrosia, to make me a Feast this Evening. Remain here a While, and you will meet her.

Ah Sir, said I, I perceive now that your Widow is more faithful than you are; for she has had many excellent Proposals of Marriage, and she has refus'd them all. I must confess to you, that I myself have lov'd her to Distraction; but she was obdurate to my Pleadings, and rejected me flatly, because of her Love for you.

Sir, he said, you have my Sympathies indeed; for she is, in Truth, an excellent Woman, beautiful and amiable. But the Abbé de la Roche, and the Abbé Morellet, do they not still continue to visit her?—Most certainly they do; for she has not lost a single one of your old Friends.—You would have been, perhaps, more successful, if (with the Bribe of some excellent Coffee & Cream) you had won over the Abbé Morellet to parley for you: for he is as subtle a Logician, as Duns Scotus or St. Thomas; he phrases his arguments so skillfully, that they become pretty nearly irrefutable. And if, (by the Gift of some fine edition of an old Classic), you had won over the Abbé de la Roche, to talk *against* you, that would have been better still; for I have always notic'd, that when his Advice to her was to follow one Course, she was mightily tempted to do the Reverse. At these Words, bearing the Nectar she had gather'd, enter'd the second Mme. Helvetius. At once I recogniz'd her to be Mrs. Franklin, my dear departed American Wife. I reclaim'd her, whereupon she answer'd coldly: I made you a good Wife for forty-nine Years & four Months—almost half a Century; let that content you. Here I have contracted a new Union, that will last all Eternity.

Mortify'd by this Rejection of my Euridice, I immediately resolv'd to quit those ungrateful Shades, & return to this good World, to see the Sun, and you. Madam, here I am! *Let us avenge ourselves!*

The latter letter was obviously written immediately after his marriage proposal had been turned down by the good lady. His lack of success as a suitor did not prevent him from continuing to pay her attention and corresponding with her until the end of his days. After Franklin's death, Madame Helvétius continued to receive distinguished philosophers, including Thomas Jefferson—and the path by Osiris's statue of Moses became known as "Philosopher's Lane."[7] It is recorded that many years afterwards Napoleon also visited the, by then old, lady and spoke of his burning ambitions to which she replied "Do you know how happy one can be on three acres of land?"[7]

In the meantime Lavoisier had been executed (1794) and his widow had married Benjamin Thompson, Count Rumford (1805). The marriage

[7] Egon Larsen, *op. cit.*, p. 138.

was very soon to become extremely unhappy and early in 1808, after an amicable separation, Rumford began to search for a new abode in which to lead a separate existence. The house which he finally chose and in which he spent the rest of his life was none other than N° 52 Rue d'Auteuil!

The house in the Rue d'Auteuil was later to be the residence of still another distinguished personage in the shape of Prince Pierre Bonaparte[8] under whose occupancy a tragic episode was to occur. In January 1870 Prince Pierre, a cousin of Napoleon III, was challenged to a duel by a M. Grousset who was the editor of *La Marseillaise*. The grounds for the challenge were that the Prince had allegedly insulted the newspaperman in public. Victor Noir, the editor's second, called upon the Prince, as demanded by etiquette, in order to arrange details of the duel, but an altercation arose and Victor Noir was shot dead by Bonaparte in the very room which Rumford had previously used as a laboratory. As may well be imagined, the incident caused a sensation in France, and the Prince was arraigned for murder. Public opinion was much inflamed, but the outbreak of the Franco-Prussian war caused the suspension of the trial which was never resumed.

DENIS I. DUVEEN
HERBERT S. KLICKSTEIN

National Historical Exhibit of the Art of the Miniature, Rome

On 27 November 1953, after two years of preparation, the National Historical Exhibit of the Art of the Miniature was formally opened in the beautiful and appropriate halls of the Palazzo Venezia in Rome. It awakens immediately the fervent hope that it will run far longer than the three months originally assigned to it. In a very real sense it is a monument not only to the history of miniature painting in Italian manuscripts and printed books from the fifth to the sixteenth century but also to the courageous restoration of Italian libraries after the horrors of World War II. The Ministry of Public Instruction and its Director General of Academies and Libraries, Prof. Guido Arcamone, are greatly to be congratulated on their achievements.

The services of Prof. Mario Salmi and Signora Cristina Arcamone Barletta to the exhibit have been particularly outstanding. The catalogue, consisting of 37 introductory pages, 522 pages of description, 5 colored plates, and 104 black and white plates, is the work of Prof. Giovanni Muzzioli and was published by Sansoni of Florence. Exactly 748 manuscripts and early printed books are listed in it, with a complement of 60 objects and paintings which bear in some way on the exhibit. Special display cases were manufactured which on the termination of the exhibit will be distributed among the various libraries.

[8] Egon Larsen, *ou. cit.*, p. 170.

The bulk of the miniatures are religious in theme. Mingled with them are some twenty items of medical interest which have not before been gathered under one roof and which afford a rare and delightful opportunity to the historian. The earliest (no. 4 in the catalogue) is the sixth century "Neapolitan" Dioscorides, in Greek, which offers 170 pages of miniatures of medicinal plants. Latin herbals are represented by a pseudo-Apuleius (no. 51) of the ninth century from Lucca: a codex (no. 59) in Beneventan script of the same century from the Laurenziana which once belonged to Gabriele Zerbi and which contains, with Antonius Musa, the pseudo-Apuleius, and other material, a series of sixteen scenes of surgical operations; and a Gothic manuscript (no. 100) of the thirteenth century, from the same library, which furnishes a portrait of Hippocrates flanked by Plato and Dioscorides. There is in addition a herbal (no. 447 in Provençal, written in the fourteenth century and now in the Nazionale at Florence; its full-page miniatures of Hippocrates, Avicenna, Johannitius, Averroes, Mesue, and Serapion are of unusual interest.

The riches of the Laurenziana are represented also in a collection (no. 11) of surgical writings in Greek, of the late tenth or early eleventh century, which derives from the library of the physician Nicetas. Various types of surgical operations are depicted in it, together with methods of bandaging to illustrate the tract of Soranus of Euphesus. Veterinary medicine appears in the fifteenth century manuscript of Laurentius Rusius from the historic Malatestiana at Cesena. The virtues of the baths at Pozzuoli are set forth in a thirteenth century manuscript (no. 415) of Petrus de Ebulo's tract from the Angelica; its geometric waves and fishes are a most enchanting accompaniment to its bathers. The Casanatense provides the *Theatrum Sanitatis* (no. 262), of which most libraries are proud to possess even the two-volume facsimile which was published in 1940, and the *Tacuinum Sanitatis* (no. 261) of the fourteenth century, which is almost an encyclopedia of natural sciences. Two manuscripts of Avicenna furnish miniatures of their author and of various sick-room scenes. One (no. 269), in Hebrew, is the proud possession of the Universitaria in Bologna; the other (no. 564), in Latin, passed from the Libreria Gaddi to the Laurenziana.

It is pleasant also to see an Isidore (no. 50) of the ninth century, from the Capitolare at Vercelli, opened at the section on medicine and at the precise page which carries a miniature of "Apollo Medicus" enthroned. And it is gratifying finally to be reminded of the popularity of Pliny, who, beginning with a manuscript (no. 153) from the Laurenziana of the late twelfth or early thirteenth century in which he is depicted presenting his history to Titus and ending with the copy (no. 576) of Jenson's 1476 Italian edition from the Angelica, is represented full seven times (also nos. 506, 563, 575, 602, 613) in the exhibit.

D.M.S.

Honorary Degree for Dr. Sigerist

On 27 November, Founders Day at the University of London, Dr. Henry E. Sigerist, one of the Editors of this *Journal,* received an honorary D.Sc. Dr. Sigerist had gone to London for this academic ceremony, and also to deliver the British Post Graduate Medical Federation lecture on "Science and History."

M. Pierce Rucker (1881-1953)

We regret to announce the death of Dr. M. Pierce Rucker on 23 October 1953. Dr. Rucker was graduated from the Johns Hopkins in 1903 and taught at the Medical College of Virginia until 1930. He was head of the Department of Obstetrics at the Johnston Willis Hospital for many years, and at various times served as President of the American Association of Obstetricians, Gynecologists and Abdominal Surgeons, the South Atlantic Association of Obstetrics and Gynecologists, and the Medical Society of Virginia. He was editor of the *Virginia Medical Monthly* and an active member of the American Association of the History of Medicine.

Medical History in Peru

For fourteen minutes medical history became medical actuality in Lima, Peru, last October when Drs. Francisco Graña Reyes and Esteban Rocca, distinguished Peruvian surgeons, successfully used surgical instruments over two thousand years old to open the skull and remove a blood clot from a Peruvian cabinet-maker, speechless since a traumatic skull injury. The operating room, the anesthesia, and the antibiotics were modern, but the bronze chisel, the copper hammer, and obsidian saws had been familiar to Incan and Pre-Incan surgeons, as had been the technique of the three-layered bandage tourniquet which was wrapped around the patient's head. Long interested in the ancient Peruvian instruments Drs. Graña Reyes and Rocca had practised for years, using the museum relics on cadavers before attempting their use on a live patient. The instruments, which were pronounced fully the equal of modern tools, were returned to the National Museum of Archeology after this truly historic operation.

MILTON CORN

A Further Note on Thomas Hodgkin's Gravestone

The Editor has received the following letter from Dr. Sam Rabson of Fort Wayne, Indiana, dated 27 November 1953.

Neither the lines accompanying the photograph of Hodgkin's gravestone in the October issue nor the note (1951, *6,* 411) to which they refer describe the story of the present stone.

On a visit to Palestine in the spring of 1929, I called upon the superintendent of the then Rothschild-Hadassah Hospital. Two photographs hung on the wall, enclosed in the same frame. One was of the late Dr.

Emanuel Libman standing next to the stone pictured in the October, 1953, issue of your Journal, while the other showed him addressing a group, with the stone (as I recall) in the background. I was then told the story of the stone.

Dr. Libman had come to Palestine earlier that year. When he visited the Protestant cemetery at Jaffa to see Hodgkin's grave, he was shocked at the condition of both grave and stone. I am sure you were acquainted with Dr. Libman, as I was, so that you are not surprised at the energetic measures he took. He cabled American friends, secured funds for the new stone (in your photograph), supervised its installation, arranged dedicatory ceremonies and, of course, placed himself on the program as principal orator. He also saw to distribution of the photographs, copies of which hung on the hospital superintendent's office walls.

Arrow Wounds

We should like to call to our readers' attention an article by Dr. J. A. Lundy, of Worcester, Massachusetts, entitled "Arrow Wounds," in the *New England Journal of Medicine* for 20 March 1952. This was the one hundred and fifty-seventh Annual Oration of the Worcester District Medical Society.

Dr. Lundy defined his topic as follows.

Etiologic agent; an arrow. This is a missile composed of a head, a shaft and a feathered end. *Pathology:* a penetrating wound in whatever part of the anatomy is struck. *Diagnosis:* the feathered end of the shaft of an arrow protruding from the subject usually indicates the diagnosis. *Complications:* in this country sepsis was the most common complication, taking the form of abscess, empyema, peritonitis or tetanus. *Treatment:* All authorities agree that one should never try to extract an arrow by pulling on its shaft—first, because of the shape of the head, which does not favor withdrawal; secondly, because the thongs fastening the head to the shaft tend to loosen inside the body; and thirdly, because the shaft is the best guide to the position of the head to be recovered. If the shaft has penetrated to the opposite side of the body and the head can be felt there, a counter incision is made. The head is then removed from the shaft, and the shaft withdrawn. This maneuver was later rediscovered and applied to the removal of fish-hooks.

Dr. Lundy cites statistics from an article by Dr. J. H. Bill, published in the October, 1862, issue of the *American Journal of Medical Sciences.*

Arrow wounds of upper extremities	28	1 death
Lower extremities	6	1 death
Head superficial	2	
Head penetrating	3	2 deaths
Spinal marrow	1	1 death
Chest superficial	9	
Chest penetrating lung	6	4 deaths
Chest penetrating heart	2	2 deaths
Abdomen superficial	6	3 deaths
Abdomen, intestine wounded	15	15 deaths

He continues with report of two cases, one from the article by Dr. Bill, and one from Hamilton's *Treatise on Military Surgery,* published at about

the time of the Civil War. The case reported below is Dr. Bill's. Today such a wound would call for the emergency service of a neurosurgeon.

Miguel Nigro, the post guide at Fort Union, was shot with an arrow by a Utah Indian. I found the arrowhead sticking in the left parietal bone, the shaft having been detached. I made traction on it and drew it out of the wound. The symptoms present at once vanished, the man turned over and sneezed, and rose upon his feet. I had made arrangements to trephine the skull if necessary, but I had probably restored to its proper level that portion of the inner table which was depressed, so that the measure was unnecessary. The cause of the depression was gone and I had nothing to trephine for. The next day the man complained of headache. His face was flushed, eyes suffused, pulse hard and irregular. I ordered croton oil, shaved his head and applied cold. Presently when delerium came on, I bled him until he fainted. This bleeding was repeated the night of the same day. The next day he was greatly better. The croton oil had operated well. The man was left to recover, which he did in three weeks.

The second case report describes an arrow wound of the maxilla in young Lieutenant Bayard (who later became a General and was killed at Fredericksburg). The patient had complications of fever, abscess, and hemorrhage over a two-month period, and was finally cured by ligation of the carotid.

Dr. Lundy uses his text as a plea both for the lessons in good medicine to be learned from old reports and outdated diseases, and in a figurative sense to discuss some the attacks being made on organized medicine by the "arrows of hostile opinion."

ROBERT J. T. JOY

Egyptian Heart Scarabs

In the June number of the *American Heart Journal* (1953, *451*, 918-924) Dr. Simon Rodbard of the Michael Reese Hospital in Chicago published an interesting paper on the heart scarab of the ancient Egyptians based on examples in the Oriental Museum of the University of Chicago. For more than a thousand years the Egyptians in performing ritual autopsies on their dead removed the viscera and replaced the heart with a stone carved in the form of a scarabaeus beetle. The earliest known heart scarabs date from 1700 B.C. and they are commonly found in mummies dating from 1580 to 1150 B.C. The practice had disappeared entirely by the time of the Christian era. Rodbard suggests that the scarab was used because of superficial similarities in form between the dorsum of the scarab and the ventral appearance of the human heart.

J. F. F.

Scottish Society of the History of Medicine

The *Journal* has just received the printed *Report of Proceedings* of the Scottish Society of the History of Medicine for 1952-53. Dr. H. P. Taft, the Honorary Secretary, writes that since the Society's founding in 1948 there

has been widespread interest in its activities and generous support on the part of the medical profession in North Britain. Dr. John Ritchie has served as President during 1952-53, with Dr. Douglas Guthrie and Mr. Walter W. Galbraith as Vice-Presidents. To date they have had seventeen meetings with four annual general meetings. On the occasion of the seventeenth meeting held on 20 June 1953 at Newcastle-upon-Tyne Dr. W. F. Mitchell, a member from Newcastle, arranged a most impressive exhibit of early medical books at King's College. This included among other things the first minute book of the Infirmary dating from 1751.

Professor Douglas Guthrie

Dr. Douglas Guthrie, the eminent medical historian of Edinburgh, is making a round-the-world tour. After lecturing in Australia and New Zealand, he anticipates spending three months in the United States, arriving with Mrs. Guthrie late in February. He will lecture on the west coast and is later giving the Logan Clendening Lectures for 1954 in Kansas City. He also has speaking engagements in the midwest and on the eastern seaboard. On 5 May, the day prior to the New Haven meeting of the American Association of the History of Medicine, he is to give a Woodward Lecture at Yale University on "The Three Alexander Monros: Their Influence and Their Writing."

Annual Meeting of the American Association of the History of Medicine—New Haven, 6-8 May 1954

Dr. Lloyd G. Stevenson of the University of Western Ontario Faculty of Medicine, London, Canada, has been appointed Chairman of the Program Committee for the Twenty-seventh Annual Meeting to be held in New Haven May 6th to 8th, replacing Dr. Samuel C. Harvey in whose untimely death the Association has lost a loyal friend. The Committee on Local Arrangements consisting of Mr. John B. Blake, Dr. Thomas R. Forbes, Mr. Frederick G. Kilgour, Dr. Paul D. MacLean, Miss Madeline E. Stanton, Mr. William B. Walker, Dr. John F. Fulton, *ex-officio*, and Miss Elizabeth H. Thomson, Chairman, will take care of arrangements in New Haven as well as assisting Dr. Stevenson.

Three sessions of this meeting will be devoted to specific topics: (i) The Historical Impact of Curative Medicine on Society (papers by invitation); (ii) The Interrelations of Chemistry and Medicine; and (iii) The Rise of Statistics in Medicine. Members wishing to submit papers for symposia (ii) and (iii) or on other subjects for the remaining two sessions are invited to send titles, together with brief abstracts, to the Chairman as soon as possible.

Members are urged to make their reservations early since New Haven has limited facilities. When sending reservations to the Taft Hotel, it

would be well to specify that you are attending the Association meeting since a bloc of rooms has been set aside for our members.

Lemon Juice and Scurvy

During 1953, the bicentenary year of James Lind's *Treatise of the Scurvy,* there were observances of the anniversary in many places and a number of journals carried editorials or papers on Lind. Edinburgh marked the occasion with a two-day symposium and a reprinting of Lind's Treatise edited by Drs. C. P. Stewart and Douglas Guthrie. From southern California, where the citrus fruit growers had good cause to honor their patron saint, came notices of several celebrations in which Captain Louis H. Roddis, the biographer of Lind, and Mr. Anthony J. Lorenz, Director of Nutrition Research of Sunkist Growers and long a student of Lind and his times, took an active part.

In view of this emphasis on scurvy, our readers may be interested in an early reference to the disease which has just come to our attention. Dr. M. B. Etziony of Montreal reports that his Jerusalem correspondent, Dr. Joshua O. Leibowitz, has discovered an excellent description in Jacob Zahalon's *Otzar Hachayim* (Venice, 1683) in which the author states that lemon juice is helpful to patients afflicted with that disease. Zahalon adds that this is a new prescription not found in the works of the ancient writers. Being a conscientious man, Lind had indicated the earlier use of citrus fruits in the treatment of scurvy, but he does not mention Zahalon. He also points out that no one before him had carried out properly controlled experiments to establish the antiscorbutic effect of citrus fruits.

J. F. F.

Modern Language Association Conference on Literature and Science

Under the chairmanship of Professor Margaret Denny of the Department of English of the University of Rochester, the Modern Language Association held a conference on literature and science at its Chicago meeting on 29 December 1953. The general topics discussed at the conference were the common problems of basic scholarship in literature and science. One of the chief speakers was Theodore Hornberger of the University of Minnesota who discussed the question, Is it essential to know how science—in method and purpose—is defined popularly and professionally during a given writer's period? Other speakers were Hyatt Waggoner of the University of Kansas City, and Joseph Beaver of Harpur College who expressed his conviction that humanists should study the "classics" of science for their literary qualities.

The Pazzini Ramazzini

The Istituto Nazionale per l'Assicurazione contro gli Infortuni sul Lavoro has just published, to mark its 70th anniversary, a new edition of

Ramazzini's *De morbis artificum diatriba* edited by Professor Adalberto Pazzini (President of the XIVth International Congress of the History of Medicine to be held in Rome and Salerno in September, 1954). The volume was published at Rome ex typographia Caroli Columbi, 1953.

Handerson Medical History Society

In Cleveland on 14 December 1953 at a meeting called by Dr. Howard Dittrick, Dr. Henry Fertig, and Miss Genevieve Miller the Handerson Medical History Society was organized. The Society was named in honor of Dr. Henry E. Handerson, one of the founders of the Cleveland Medical Library Association and its President from 1896 to 1902. In addition to translating Johann Hermann Baas' *Grundriss der Geschichte der Medicin,* to which he added considerable material, especially on English and American medical history, Dr. Handerson wrote extensively on medieval medicine.

Dr. Clyde L. Cummer served as chairman of the first meeting of the new Society at which working plans were drawn up and general policies decided upon. At least three meetings will be held each year and membership will be open to all in Cleveland and vicinity who are interested in the history of medicine. Dr. Henry Fertig was elected President, Genevieve Miller, Secretary-Treasurer. After the business meeting Miss Miller spoke on "The History of Medical History," illustrating her remarks with representative works from the historical collections of the Cleveland Medical Library and the Armed Forces Medical Library. Dr. Cummer concluded the meeting with personal reminiscences of Dr. Handerson.

Book Reviews

MARTHA TEACH GNUDI and JEROME PIERCE WEBSTER. *The Life and Times of Gaspare Tagliacozzi, Surgeon of Bologna, 1545-1599,* with a documented study of the scientific and cultural life of Bologna in the sixteenth century. Preface by Arturo Castiglioni. New York, H. Reichner, 1950. xxiv + 538 + 3 pp., 76 illus. $15.00.

Reviewed by W. W. FRANCIS, *Librarian, Osler Library, McGill University, Montreal, Canada.*

HERE is a book that deserves all the praise that has been and can be given it, the product of twenty years of team-work by an eminently expert surgeon and a scientifically trained historian, both of them scholars who know how to ferret out and to use the original sources. It brings to life a neglected if not forgotten pioneer who laid the foundations of plastic surgery in the sixteenth century, before his contemporaries were prepared to follow his lead. Dying at the comparatively early age of fifty-four in 1599, two years after the publication of his great work, he escaped, though his reputation for a while did not, the detraction and misunderstanding which innovation so often incurs.

After reading every word of this spacious "Life and Times" the admiring reviewer turns to the Preface and despairs of giving any better description than this by Castiglioni (of affectionate memory):

> For the first time we find clearly set forth and richly documented in these pages the most important facts and the causes of the evolution of reparative surgery from its empiric crude beginnings into a rationally conceived and ably practiced art. The personal life of Tagliacozzi and his family, his progress in his chosen field of work, and his contacts with the Gonzaga, the Este, and the Medici courts, are likewise authoritatively interpreted from documentary sources, while some particularly interesting passages are devoted to his teachers Aranzio and Aldrovandi, to the quarrels that arose in connection with the preparation of the famous theriaca, and to his care of the illustrious patients who constantly sought his surgical skill. A detailed analysis of the treatise of Tagliacozzi is followed by a description of his popularity and influence and by a balanced exposition of the opposition to which his work was later subjected by enemies and detractors. The volume closes with a history of rhinoplasty in the early nineteenth century and its achievements in more recent times and with an excellent summary of the role of Tagliacozzi in this history.
>
> The biography of Gaspare Tagliacozzi, now completed with admirable accuracy, is interpreted with the understanding of a distinguished modern plastic surgeon and is enriched with copious notes and many hitherto unpublished documents. It is a notable contribution not only to the history of medicine, but also to the history of university life and the social and political life of the Renaissance.

Chapter XI is a really masterly summary in 34 pages of Tagliacozzi's great work whose title may be translated as Grafting in the Surgery of the

Maimed. The 22 plates are here reproduced, as is also the only translation, namely, that of the most important Book II, which Alexander Read appended to his rare "Chirurgery," 1687.

An interesting attempt is made to explain Tagliacozzi's posthumous and temporary condemnation by the religious authorities and the astonishing misunderstanding and neglect of his methods by his surgical successors. If the attempt is not entirely successful, it is not the authors' fault. They are probably right in deprecating the effect of the ridicule to which the mending of noses lent itself and the crazy idea that the new nose, as in the famous passage from *Hudibras,* was taken from the *brawny* part of a humble buttock and would fall off when the donor died! The modern plastic surgeon is not disconcerted by the alleged hitchhiker whose nose, reconstructed from his thumb, turns to the right as each car passes; still less by Mr. Punch's pungent jibe:

> The lifted face of Mrs. Lumpley-Smith
> Grins on the threshold of the Great Unknown;
> She has a few more years to dally with
> Ere putrefaction claims her for its own.

The book is magnificently printed in Italy, and one can only wonder at the astonishing rarity of misprints. Slips and inaccuracies are almost as scarce. Isabetta, Tagliacozzi's daughter, takes the name Calidonia and the veil (p. 94) in 1591 at the age of fourteen, and at the end of the paragraph it is confusing to find, without comment, that Calidonia, evidently a sister, died in 1586. Because in Italian *università* can mean a guild of any sort is no reason for calling the University of Bologna "the Studium" in English. It is an extra polite Catholic nowadays who calls the "Holy Office" the *Holy* Inquisition (p. 31), and your Londoner will gasp at the "College of Physicians, Lincoln's Fields" (p. 318). Probably nobody else since Clement of Alexandria has called the Apocryphal romance of Toby "canonical" (p. 186). One very sore point: the only bit of bad Latin is ascribed to me (p. 280), whereas both De Renzi and I copied that title of Cavalli's book correctly!

Lavishly printed and illustrated, the work is worthy to stand with Tagliacozzi's original close to Vesalius. The documentation is exceedingly generous. In many cases one is given the original document in photographic facsimile, in transcription into its Latin or Italian, and in translation, a boon to the student interested in sixteenth-century paleography and linguistics. The publisher has not been obliged to economize, so the footnotes and references are where they should be. If the listed price were doubled, the book would still be a gift, and the work should be a permanent testimonial to American scholarship.

OYSTEIN ORE. *Cardano: The Gambling Scholar.* With a translation from the Latin of Cardano's *Book on Games of Chance* by Sidney Henry Gould. Princeton University Press, 1953. xiv + 249 pp. $4.00.

Reviewed by CARL B. BOYER, *Professor of Mathematics, Brooklyn College, Brooklyn, New York.*

THIS is a fascinating book; and how could it be otherwise? It deals with the most eccentric and ingenuous genius of that curiously chameleon-like period between medieval and modern science—a scholar whose life was as full of contrasts as were the intellectual currents of his day. From a university rectorship he went to the poorhouse; condemned by the Inquisition, he died as a Papal pensioner. Outstandingly successful as was his medical practice, his mind (like those of his fellow physicians, Paracelsus and Nostradamus) was ridden by superstition: he was ever on the look-out for portents; he made predictions on the basis of dreams and thunderstorms; he believed that he (like Socrates) was guided by a personal demon. The reputation he acquired through his cure of the malady (an allergy?) of Archbishop Hamilton of Scotland, Cardan very nearly lost by casting for Edward VI of England a horoscope vouchsafing long life! Remembered today as a pioneer of the new age of mathematics, Cardan has earned his contemporary fame through medical and scientific works which in spirit belong to the later middle ages. That today he is something of an enigma is not surprising, for he was a paradox even unto himself. No other scholar has spent more time, or been more candidly self-contradictory, in thinking and writing about himself and his contemporaries than Cardan. (What an opportunity he afforded for psychoanalysis, for he had an abnormally vivid imagination, a facile pen, and an almost modern appreciation of the psychic factor in health and disease.)

No distinguished scientist, not even the astronomer Johann Kepler, has presented such a mixture of sense and nonsense as did Jerome Cardan. His treatises are full of good advice, although he did not practise what he preached. He counselled physicians not to gamble—if one wins, he will be stigmatized a gambler; if one loses, his patients will adjudge him to be as inept in medicine as in gaming—yet he himself gambled incontinently. The enormity of his literary production is overwhelming, for he wrote over four hundred books, of which roughly a third had been published before his death and another third burned by his own hand. Among the third which survived in manuscript form was the *De ludo aleae* which inspired the book under review.

This volume consists essentially of three parts. The first, comprising almost two-thirds of the whole, contains an account of Cardan's life, broken up into four chapters: (1) "The Stormy Life of Cardano," (2) "Cardano's Enigmatic Character," (3) "The Battles of the Scholars," and (4) "Cardano, the Gambler." The account is largely a personal one, supported by numerous quotations from Cardan's *De vita propria.* One does not get

much of an impression of the intellectual life of the day, and Cardan is not placed in perspective in the history of science, either in time or with respect to his contemporaries. At least one reader wishes that the author had emphasized more Cardan's contributions to learning and less the vicissitudes of his life and the oddities of his character. In particular, virtually the whole of the third chapter, the longest in the book, is given over to the notorious and bitter Cardan-Tartaglia controversy, with all the familiar details presented once more in an impartial but verbose account leaning heavily on quotations from Tartaglia. Some, at least, of this space might have been devoted to an analysis of the actual solution of the cubic equation—the developments which made it possible and its significance for the history of mathematics. But then nothing comes easier to a reviewer than to suggest ways in which a good book might have been made better. In only one field, that of mathematical probability, did Ore evidently intend his *Cardano* to be an evaluation of contributions to learning. Hence the first four chapters should be looked upon as an introduction to the last and most significant, "The Science of Gambling." Cardan's *De ludo aleae* had been published posthumously in the sumptuous *Opera* of 1553, and hence its existence had been known to later scholars, after the foundations of probability had been independently established by Pascal and Fermat through their correspondence of 1654. Nevertheless, no one had taken the trouble to make a thorough study of it, to disentangle the sound mathematics from the foggy thinking. The reader is genuinely indebted to Professor Ore for having undertaken a task which even the indefatigable Todhunter (*A History of the Mathematical Theory of Probability*) and the erudite Cantor (*Vorlesungen über Geschichte der Mathematik*) had eschewed.

Cardan's definition of probability was essentially that used today; and on the basis of this he correctly computed probabilities associated with throws of dice—one, two, or three at a time. Where Cardan was in error (for his notes were so disorganized that he did not bother to delete material corrected in later sections), Ore shows just how the calculation went awry. This frequently occurred through a specious kind of "reasoning on the mean" in which it was assumed that since the probability of a five, for example, on a single throw of a die is 1/6, the probability of at least one five in three throws of a die will be 3 (1/6) or 1/2, whereas in reality it is 91/216—a correction which Cardan himself subsequently made. After some fumbling in connection with the odds on continued success in independent repetitions of a game of chance, Cardan arrived at the equivalent of the modern power law $p_n = p^n$, where p_n is the probability of winning n times in succession a game in each play of which the probability of success is p, a result for which Ore suggests the name, "Cardan's formula." *De ludo aleae* contains also some simple probability calculations associated with other games, using "blind dice," playing cards, or the ancient astragals. Ore's exposition of Cardan's ideas, which in this new field were necessarily

somewhat vague, is remarkably lucid. This makes one wish that he had gone further to include also the related work of Cardan on the application of Pascal's triangle to the theory of combinations, where the result $\sum_{i=1}^{n} {}_nC_i = 2^n - 1$ for combinations of n different objects has been known as "Cardan's formula." And, while wishing, one could ask for more extensive scholarly apparatus—more specific references and a more helpful bibliography.

One should not pass over in silence the translation of *De ludo aleae,* with which (apart from the index) the volume closes. Here Professor Gould has given a version which will be much appreciated, for it is clear, smooth, and unpretentious. Attention may also be called to the thirty-odd illustrations, mostly reproductions from works of Cardan. These diagrams, unco-ordinated with the text, show Cardan to have been quite a gadgeteer, a facet of his life commemorated in the "Cardan suspension" but otherwise easily overlooked. Such illustrative material adds to the attractiveness of a book which is well put together, artistically as well as intellectually—even to the reproduction of "The Card Sharpers" by Caravaggio which adorns the handsome dust jacket.

SOLOMON R. KAGAN. *Jewish Medicine.* Boston, Medico-Historical Press, 1952. 575 pp. $10.00.

Reviewed by LOUIS H. NAHUM, *Lecturer in Physiology, Yale University School of Medicine, New Haven, Connecticut.*

THIS compilation of Jewish medical scientists throughout the ages is but another in a large number of similar volumes on the Jew in medicine. The occasion, however, of this one is to celebrate the sixtieth birthday of the author. The notables on the celebration committee are impressive, among them being Einstein, Castiglioni, Neuberger, Zondek, Fishbein, and forty-nine others. The book opens with four brief chapters, one by Hyman Morrison on the author's biography, a tribute by Prof. Max Neuberger, an appreciation by Reuben Friedman, and a letter of greeting from Abraham Levinson of Israel. There follow chapters on biblical and Talmudic medicine, Medieval medicine, the Renaissance period, the seventeenth and eighteenth centuries, and the modern period.

The author undertakes an almost impossible task in trying not only to present the significant achievements of Jewish medical scientists but also "to evaluate their contributions in the light of their influence on medical progress." The first must become a sort of anthology; the second, requires a complete understanding of the historical evolution of medical thought. The first purpose is inadequately realized, the second not at all. The realization of the second purpose, however, would have been adequate justification for this volume (regardless of the pseudo-scientific nature of its title). Since medical science is universal, it is built upon successive contributions of individuals of diverse nationality, not on the product of "nations." The

dangers of the "national" approach beset this volume, for we find the thread of medical ideas broken, the historical evolution of science lost, and the book but another of a long series on "Jewish Apologetics."

The reviewer would welcome a book on Jewish Apologetics in medicine if it presented what everyone wants to know about Jewish psychology and sociology—an explanation of the prodigious contribution to medical science of such a numerically insignificant group as the Jew. When one reflects upon the Jews in the Judeo-Arabic period, the high percentage of Jewish mathematicians in Italy, the relatively preponderant number of Jewish names among the great physicians in Germany, one is struck by this unique phenomenon of our civilization. From ancient times when hygiene and sanitation were an integral part of Jewish law and life until the present, wherever and whenever the Jews were permittd to study and work in universities their contribution to medicine was astounding. To what is this due? Is it heredity? Is there something in the religion of Israel that directs Jewish efforts into the medical sciences? Are there reasons not yet uncovered by scholars in this field?

The Talmud and Maimonides as a physician offer an excellent field in which to analyze Jewish psychology and sociology. Twenty-two pages are devoted to Talmudic medicine. The Talmud is a mirror of the life of the Babylonian period of Jewish history and casts its shadow upon the Rabbinical period which followed in Europe. In it can be found the habit of thought, the way of life, the cast of mind of the Jewish people. The author deals with the scientific rationalism of the Talmudic Rabbis. Actually, the historic record shows their contribution to medical thought was very small. Talmudic medicine was a mixture of rational and magic practices characteristic of the time, and only much later when the breakdown of the Ghetto environment freed individuals from Talmudic preoccupation do we find a great flowering of Jewish genius in science and mathematics. For science is universal and its growth cannot take place in environments as hermetically sealed from the stream of thought as was the Ghetto. However, this release from traditional Jewish culture, so important to the world, brought with it a great tragedy to the Jewish people. Many of the great ones grew away from Jewish life and culture which were the mainsprings conditioning their creative efforts. Although the author claims the Marranos for the Jewish people, in truth the Marrano movement was a serious break in Jewish life and in the end a great loss to the Jewish people.

In the life of the great Maimonides the author also had an opportunity to assess the fundamental problem of the Jew in medicine, for here was a great genius who fled persecution twice, finally to achieve fame in both medicine and philosophy. He was not only intellectually endowed with great powers, but it is obvious that these powers were sharpened by reason and the love for health and humanity that springs from strict adherence to the ethical, hygienic, and moral codes of Judaism. But in three pages Maimonides cannot be set in his historical perspective, nor can such

abbreviation permit a scholarly analysis as to how Jewish life and faith made such a genius possible.

What the author achieves is another anthology and an inadequate "Who's Who." If we are to have a "Who's Who," at least let's have a complete one. Throughout the 564 pages, especially in the modern section, there are physicians, who, though alive, are already forgotten, while there are many missing who yet have left enduring monuments to medical science. Most perplexing is the author's myopia with regard to great doctors in the very city in which he lived and practised. For Blumgart is not mentioned, nor Schlesinger, Aub, Zoll, Riseman, nor Levine, to mention but a few who have added much to medical thought. It is, therefore, not surprising to find missing in the anthology the great Jews in medicine in other sections of the country and abroad. Not mentioned is Milton Winternitz who built a new medical school at Yale and started a new experimental approach to medical education; Abraham White, great protein chemist, who crystallized prolactin and contributed prodigiously to immunology; Rudolf Shonheimer, man of vision and imagination who first employed stable isotopes to study intermediary metabolism; Leonard Greenburg, leader and contributor in the field of industrial medicine; Louis Goodman and Alfred Gilman, famous pharmacologists; Harry Zimmerman, renowned teacher, organizer, and investigator in neuropathology. Missing also is Alfred Schatz, co-discoverer of streptomycin, and Harold Himwich, famous cerebral pharmacologist, and a host of other great Jewish scientists throughout this country. Even in Europe where personal prejudice could not explain oversight we find missing such great names in psychology and psychiatry as Binet of Paris, Victor Adler of Prague, Emil Kraepelin of Dorpat. In fact, psychiatry owes so much to Jewish scientists, an analysis of Jewish traditional religion, life, and thought should have been highly rewarding especially in this field. Here perhaps the author's title could have found some support. However, nowhere do we find any suggestion that the volume was concerned with the full implication of the chosen title.

One could overlook the very bad printing with innumerable typographical errors and occasional loss of whole phrases if we were given some insight into Jewish psychology and sociology, so that the reader would find the explanation for the vital rôle of Jewish medical scientists in the development of medical thought.

CHAUNCEY D. LEAKE. *The Old Egyptian Medical Papyri.* Logan Clendening Lectures, Second Series, on the History and Philosophy of Medicine. Lawrence, University of Kansas Press, 1952. 7*ll.* + 108 pp. $2.00.

Reviewed by JOHN F. FULTON, *Sterling Professor of the History of Medicine, Yale University School of Medicine, New Haven, Connecticut.*

CLASSICAL scholar, Egyptologist, pharmacologist, and medical educator, Chauncey Depew Leake, now Vice President of the University of Texas and Dean of its Medical Branch at Galveston, gives us an authoritative sum-

mary of the eight chief Egyptian medical papyri dating from 1900 B.C. to 1200 B.C. Chief attention is given to the Edwin Smith Surgical Papyrus, which Dr. Leake rightly describes as an "astonishing document." There is strong evidence, however, that the text of the papyrus long antedates its date of transcription, being probably written about 3000 B.C. As such it is the oldest medical document of which there is record. Dr. Leake's analysis of the several papyri is both critical and judicious; it is also most illuminating. In summary he says:

> Careful perusal of the eight available old Egyptian Medical Papyri cannot fail to result in some degree of astonishment at the relatively high character of medical knowledge possessed by the old Egyptian physicians, in contrast as is usual with the superstitious attitude about sickness on the part of the people. Extensive knowledge and observation both of disease and of effective methods of treatment seem to have been subjected professionally to analysis, classification, and arrangement. The organization of the material indicates wise consideration with resulting logical if unconscious analysis; some of the subject matter seems to have been arranged for professional teaching purposes, as indicated in the Edwin Smith and Ebers Papyri. The basic approach to individual instances of disease in particular patients, by examination, diagnosis, prognosis, and treatment, is fundamentally logical, and is still followed today.

SIR RUSSELL BRAIN. *The Contribution of Medicine to Our Idea of the Mind.* The Rede Lecture for 1952. Cambridge, Cambridge University Press, 1952. 30 pp. 50 cents.

Reviewed by PAUL D. MACLEAN, *Assistant Professor of Psychiatry (Neurology and Physiology), Yale University School of Medicine, New Haven, Connecticut.*

THIS Rede Lecture was delivered at Cambridge in May 1952. "I speak of idea rather than knowledge," Sir Russell says in explaining the title, "for my approach is to be critical, and I do not wish to imply that all the new ideas are necessarily true." Then he adds, "and I speak of the mind, quite openly and unashamedly, not being one of those philosophers who make their living by expounding the non-existence of their own minds." Thus a neurologist, mindful of the Humanity-Logic-Philosophy triad of his lectureship, straightway and good-humoredly sets the limits of his discourse for his lay audience.

Without going into detail, he emphasizes the progress that has been made in showing correlations between "brain structure and mind structure." But the emphasis is not all on the contributions of modern neurology, neurophysiology, and electroencephalography. In regard to the analysis of the mind itself, great weight is given to the explorations and findings of modern psychology. This may surprise those who are aware of an intellectual antagonism that displays itself not uncommonly between neurologists and psychiatrists. But it is without any note of condescension or pose of reconciliation with the psychiatrist that the Lecturer arrives at the conclusion

that "Freud has been as revolutionary in his influence upon our ideas of the mind as Darwin upon our beliefs about the body."

The rest of the lecture is largely concerned with two imponderables—the nature of mind and the mind-body problem. The audience is reminded that "mind" involves much more than consciousness, "or to put the same thing in another way, there are large and important parts of the brain which are concerned with functions of the unconscious mind in the broadest and most comprehensive sense, which include solving problems while we sleep, making jokes, creating the characters who people our dreams, and contributing that vital element which we call inspiration to the work of the artist, poet, and novelist." Allusion is then made to some of the ethical problems that arise when the unconscious mind leads to deviant behavior. This in turn raises the question whether or not "states of mind" are caused by "states of brain" or by "the interplay of psychological forces."

At the foregoing juncture, the Lecturer finds it impossible to "evade" some discussion of the mind-body problem. And according to him "it makes a considerable practical difference whether you are a dualist or a monist" in this regard. What stand he himself takes in this matter will not be answered here. Rather it is hoped that by concluding our remarks at this point, the reader will be left in an air of suspense that will entice him to enjoy the reading of Sir Russell's lecture.

GEORGE KIMBALL PLOCHMANN, Ed. *The Resources of Leonardo da Vinci.* Papers delivered at Southern Illinois University, November 12th-15th, 1952. Carbondale, Illinois, Southern Illinois University, 1953. viii + 39 pp. $1.00.

Reviewed by JOHN F. FULTON, *Sterling Professor of the History of Medicine, Yale University School of Medicine, New Haven, Connecticut.*

THE three-day symposium on Leonardo, held at Southern Illinois University, bears evidence of the world-wide interest in all the many facets of the unique genius of Leonardo da Vinci—as Dr. Plochmann says in the Foreword, "The celebrations carry the obvious implication of his astounding universality of mind. . . . " Of the eighteen papers presented only three are published in detail, the others in abstract. The three given in detail were those by A. Didier Graeffe, "Leonardo's humanism and our time"; Harry J. Hahn, "Leonardo da Vinci, painter"; and the Editor's general résumé, "Leonardo da Vinci as philosopher." One earnestly hopes that those presented in abstract form will ultimately be published, for they represent such diverse topics as J. Cary Davis's "Leonardo's debt to Greece and Rome"; H. S. M. Coxeter on Leonardo's mathematics; Harold M. Kaplan on Leonardo's anatomical studies; Elbert H. Hadley on "Leonardo and the experimental method"; and others on Leonardo as a physicist, pioneer in aviation, contributor to geology. Perhaps as interesting as any of the presentations is Miss Madeline M. Smith's on "Leonardo and France." The

spirit of this Leonardo da Vinci Festival can perhaps best be conveyed by quoting the final paragraph of Mr. Harry H. Hahn's restrained discourse on Leonardo as a painter:

> I cannot agree that Leonardo always merits the unquestioning awe sometimes accorded him; yet it must be conceded that as a mortal man he fills us with wonder. On no other person have been bestowed so many rare gifts. He could delineate with overwhelming eloquence the ugliness of life and the terror of death. He set before himself an heroic standard of workmanship, and time has rendered the verdict that in the esteem of all the world he stands in the front rank of the masters.

N. S. PAPASPYROS. *The History of Diabetes Mellitus.* Foreword by R. D. Lawrence. Privately printed by Robert Stockwell, Ltd., London. xv + 100 pp. [No price stated.]

Reviewed by JOHN F. FULTON, *Sterling Professor of the History of Medicine, Yale University School of Medicine, New Haven, Connecticut.*

THIS is an interesting book, well organized, with excellent balance, but it is a great pity that the author, who lives in Oxford, did not submit the manuscript to one of his many friends and admirers in the University to polish and clarify his English. Well versed in the historical texts, both ancient and modern, of his native Greece, Dr. Papaspyros has obviously not yet resided long enough in England to become fluent in the idiom of his adopted country.

As with every disease entity in clinical medicine, the story of the early recognition of diabetes, forms of treatment, and the ultimate discovery of its cause is of intense interest, and despite the faults of English the author has told the story well. In the Papyrus Ebers of *circa* 1500 B.C., there is a prescription for stopping polyuria, and it is thus possible that diabetes was known to the early Greeks. It was clearly recognized in Sanskrit texts of the sixth century A.D. Indeed, they gave a special name to the condition, 'Madhumeha,' meaning urine sweet as honey. They recognized, further, that the disease is accompanied by thirst, muscular weakness, and a pungent bodily odor. There are also allusions to the condition in early Japanese and Chinese medical literature.

The author cites the celebrated description of diabetes given by Aretaeus in the second century A.D.:

> Diabetes is a wonderful affection, not very frequent among men, being a melting down of the flesh and limbs into urine. The patients never stop making water, but the flow is incessant, as if the opening of aqueducts. Life is short, disgusting and painful; thirst unquenchable; excessive drinking, which, however, is disproportionate to the large quantity of urine, for more urine is passed; and one cannot stop them either from drinking nor making water. Or if for a time they abstain from drinking, their mouth becomes parched and their body dry; the viscera seem as if scorched up; they are affected with nausea, restlessness and a burning thirst; and at no distant term they expire.

There are many other references to the condition among ancient writers, but in none is it so well described as in Aretaeus.

The author then deals with the history of the pancreas, history of diabetic treatment, and the discovery of insulin. Under diabetic treatment he pays well-deserved credit to the English physician, John Rollo, who in 1797 published his famous study of diabetes mellitus. It was Rollo who first insisted that diabetics thrived better on a meat diet than on fats, and what we now refer to as carbohydrates should as far as possible be excluded from the diet. Dr. Papaspyros' account of the discovery of insulin is fairly stated and the story well told.

WEBB HAYMAKER, Ed. *The Founders of Neurology*. Springfield, Ill., Charles C Thomas, 1953. xxvii, 479 pp. $10.50.

Reviewed by PAUL I. YAKOVLEV, *Director, Psychiatric Training Faculty of Massachusetts, Inc., Boston, Massachusetts.*

THIS attractively published volume was conceived on the occasion of the Fourth International Neurological Congress held in Paris in 1949. The ostensible objective of the volume is to acknowledge the historical and cultural unity of present-day neurology with its sources, personified by the neuroanatomists, the neurophysiologists, the neuropathologists, the clinical neurologists, and the neurosurgeons, who lived and worked during the hundred years preceding the Congress. The editorial clause of being no longer among the living imposed a tactful limitation on the inclusion in this volume of the biographies of many living men highly representative of this period of development of neurology. The biographical sketches of 133 protagonists and exponents of neurology are written by 84 contributors to the volume. The keynote of all biographical sketches is the man rather than his works. The sketches, none of which is in excess of five pages, follow more or less an identical pattern of exposition: a brief account of the origin and cultural background, the education and training, the *exegi monumentum* in major contributions to neurology, all this interspersed with the more or less anecdotal information (Dantesque or Picaresque, as the case may be) on the life and personality of the man. Each biographical sketch is provided with a portrait. These portraits are often as revealing as the stories which accompany them. While some portraits (or perhaps their reproductions) leave something to be desired, most are excellent. The majestic heads of Helmholtz, Charcot, du Bois-Reymond, Kölliker, Vulpian, Babinski, the patriarchal Gudden, Meynert, Luciani, the impeccable Victorian elegance of Ferrier, Gowers, Langley, the glamour of the second empire in the medallion of Landry de Thézillat, and the striking pictures of many other memorable figures honored in the volume eloquently bespeak not only the personalities of the men but reflect the time of which they were the stuff. The biographical sketches, tributes written by men of science and medicine, not of letters, give at times the impression of somewhat

belated obituaries or redound with dithyrambic clichés which, if given a second thought by the writers, could have been avoided. Yet, as a whole the book makes absorbing reading. Its major point of attraction is in that it stimulates and feeds the natural and wholesome curiosity of every thoughtful reader to learn something personal of the men whose names often were familiar from medical school days, yet whose human side became all but lost in the abstraction of signs, syndromes, diseases, nerve tracts, nuclei, reflexes, instruments, methods, theories, and like semantic paraphernalia of neurology which one has learned to associate with these names.

J. P. STRÖMBECK *et al. Kungl. Serafimer Lasarettets Jubileums Utställning, 1752-1952.* Stockholm, 1952. 48 pp.

Reviewed by ADOLPH B. BENSON, *Professor Emeritus of German and Scandinavian, Yale University, New Haven, Connecticut.*

SWEDEN has long been interested in the history of medicine and surgery, and in medical practitioners. The work before us is a result of this interest and is a valuable, illustrated catalogue of 76 selected items from an exhibition held last year in honor of the two hundredth anniversary of the founding of the Royal Serafimer Hospital in Stockholm, an institution that has served the public continuously since 1752. In addition to a description of a fascinating lot of material connected with the development of the medical sciences, the catalogue also contains a history of the origin of the Serafimer Hospital idea, beginning in 1731, and a list of the principal medicinal plants grown in the Hospital garden, such as the poppy, tobacco, and camomile. Many experts have contributed to this unique catalogue, and the amount of information condensed within the space of 48 pages is extraordinary.

Some of the items described in the booklet will prove a revelation to many consultants. We find there listed not only portraits of outstanding physicians and surgeons and descriptions of the various types of surgical instruments of the periods involved, but also architectural plans of the hospital building in question, maps, account papers, a photographed reproduction of a sacramental silver service, and lottery tickets used in raising funds for the hospital. Since the material itemized represents only a fractional part of that collected and studied, the authorities are looking forward to the erection of a medico-historical museum.

J. M. MACKINTOSH. *Trends of Opinion About the Public Health 1901-1951.* (Heath Clark Lecture 1951.) London, New York, Toronto, Oxford University Press, 1953. 201 pp. 12/6 or $3.50.

Reviewed by CHARLES-EDWARD A. WINSLOW, *Professor Emeritus of Public Health, Yale University, New Haven, Connecticut.*

DR. Mackintosh's book is not a contribution to the history of the basic sciences underlying medicine and public health, but a review of the problems which have arisen in the application of those sciences to English

society during the past half century. Its special value lies, not in a detailed analysis of health legislation itself, but in a study of the social and administrative impacts of that legislation and—particularly—in the psychological motivations and repercussions involved. It includes well-chosen quotations from "White Papers," Commission Reports, Parliamentary Debates, editorials and letters appearing in *The London Times,* as well as in professional journals, which furnish an illuminating background for consideration of the basic issue of centralized administration versus decentralized local autonomy.

Medical science is an art which does not flourish in a vacuum. Such an analysis as Dr. Mackintosh has given us of psychological reaction to health legislation is a much more laborious task than a review of technical journals and legislative records; and it should be extremely valuable to the specialist in medicine and public health, as well as to the would-be social reformer. It should please Henry Sigerist.

MORRIS FISHBEIN, Ed. *1953 Medical Progress. A Review of Medical Advances during 1952.* New York-Toronto, Blakiston Company, 1953. xii + 301 pp. $5.00.

Reviewed by GEORGE ROSEN, *Professor and Head of the Department of Public Health Education, School of Public Health, Columbia University, New York, New York.*

An interesting and relatively little studied aspect of the history of medicine is the development of various forms of medical literature. There is probably small doubt, however, that when the history of this subject in recent times is studied and written, the type of publication known as the yearbook will occupy a prominent place. The need for the production of such reviews is incontestable by the very logic of the situation. As research in medicine and its allied sciences moves on, and as the results of such research continue to be applied, it becomes ever more necessary to provide reviews which permit of rapid orientation on the part of the reader. In essence, these reviews serve two functions: to provide a frame of reference in terms of which the physician can orient himself rapidly in a given field and, then, to sift current literature critically so that the busy practitioner, teacher, or research worker may acquaint himself quickly with what seems significant in his particular field of interest.

Such review volumes are a specific form of medical journalism and stem from earlier versions that originated in medical periodicals. Formerly, review articles were published in journals such as Müller's *Archiv,* Virchow's *Archiv,* Pfluger's *Archiv,* and others. In fact, such reviews are still published by the *American Journal of the Medical Sciences* as well as other journals. For convenience as well as the desire to cover a wide range of subjects, annual review volumes have now become a characteristic feature of the medico-literary scene. The volume edited by Dr. Fishbein is the latest of

these and is aimed specifically at the practitioner. It contains articles in cardiology, surgery, infectious diseases, hypertension, rheumatic diseases, nutrition, new drugs, dermatology, urology, psychiatry and psychosomatic medicine, obstetrics, diseases of the chest, ear, nose and throat, gastro-intestinal disorders, allergy, and orthopedic surgery. For the historian of medicine this volume as well as others of its kind is of interest because it is part of the raw material out of which the written history is created. In addition, it permits the historian to keep an eye on trends in medicine bearing on his interests. The volume has bibliographical references and an index.